RVR & J C COLLEGE OF ENGINEERING, CHOWDAVARAM, GUNTUR-19
(Autonomous)

R-18 REGULATIONS

Regulations, Scheme of Instruction, Examination and Detailed Syllabi for 4-Year B.Tech Degree Course In

Electrical & Electronics Engineering
(Semester System)

THE INSTITUTION

Established in 1985, Rayapati Venkata Ranga Rao & Jagarlamudi Chandramouli College of Engineering, Guntur is the 'Jewelin the Crown'of Nagarjuna Education Society, which took upon itself the responsibility of enriching the society through promotion of education, literature and culture. As it always happens, the genuine intentions of the promoters of the society received the support of the Almighty. Today eight educational institutions are functioning under the banner and patronage of Nagarjuna Education Society, with R.V.R. & J.C. College of Engineering, being the flag-ship of them

Institute Vision:

To develop integrated manpower with right attitude, possessing knowledge and skills, required to make an honourable living and contribute to the socioeconomic development and welfare of the society.

Institute Mission:

- To produce globally agile graduates with value orientation, professional competency, critical and creative thinking and lifelong learning.
- To enrich the society through education and research by generating proficient manpower, capable of contributing to the needs of the industry.
- To provide conducive learning environment, encompassing knowledge, communication and soft skills that enables the students to transform themselves into global leaders.

Institution Quality Policy is “Establishment of quality assurance system with continuous evaluation and monitoring to impart the best education to create ambience of excellence, recognizing the multicultural diversity and commitment to transform and assimilate the excellence in education and value system."

EEE Department Vision:

"To impart education leading to highly competent professionals in the field of Engineering who are globally competent and to make the Department a Centre for Excellence"

EEE Department Mission:

"Integrated development of professionals with knowledge and skills in the field of specialization, ethics and values needed to be employable in the field of Electrical Engineering and contribute to the economic growth of the employing organization and pursue lifelong learning"

Program Educational Objectives of B. Tech Program in Electrical & Electronics Engineering:

PEO I. To facilitate the students to become Electrical & Electronics Engineers who are competent, innovative and productive in addressing the broader interests of the organizations & society.

PEO II. To prepare the students to grow professionally with necessary soft skills.

PEO III. To make our graduates to engage and excel in activities to enhance knowledge in their professional works with ethical codes of life & profession.

Program Specific Outcomes of B. Tech Program in Electrical & Electronics Engineering:

Graduates of the program will be able to demonstrate knowledge

PSO1) In developing, Testing, Operation and Maintenance of Electrical & Electronics systems.

PSO2) In programming skills needed to develop application oriented software using C, Python, Java, Matlab, PSPICE, PSCAD, Labview etc..

PSO3) In Environmental issues and Green technologies.

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

PO1) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3) Design/development of solutions: 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.

PO4) Conduct investigations of complex problems: 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.

PO5) Modern tool usage: 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.

PO6) The engineer and society: 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.

PO7) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10) Communication: 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.

PO11) 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.

PO12) Life-long learning: 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.

Department Profile

Department of Electrical and Electronics Engineering

The Department of Electrical and Electronics Engineering was established during the academic year 1994 - 1995 with an intake of 60 students. The intake has been enhanced to 180 students from the academic year 2012 -2013. The Program was accredited and awarded 'A' Grade for Five years by National Board of Accreditation of AICTE in the year 2002, Reaccredited for Three years in 2007, 2012 and 2017.

The EEE department was permitted to start M.Tech course in Power Systems Engineering by AICTE, New Delhi, from the academic year 2004-2005 with an intake of 18 students.

EEE department is supported by well experienced & dedicated Faculty and skilled Non – Teaching staff. Faculty of EEE department are specialized in the core areas of Electrical & Electronics Engineering like Power Systems, Power Electronics, Control Systems, Electrical Machines & Industrial Drives, High voltage Engineering etc. Electrical installations of all laboratories and buildings are maintained by the department staff as an essential service since the inception of the college.

The department has the following laboratories with latest equipment as per AICTE norms.

1. Basic Electrical Engineering Lab
2. Advanced Electrical Machines Lab
3. Electrical Measurements Lab
4. Control Systems Lab
5. Microprocessors & Microcontrollers Lab
6. Power Electronics Lab
7. Computer Applications Lab
8. Power Systems Lab
9. Basic Electronics Lab
10. Electrical Workshop Practice Lab
11. Project Lab

In tune with the mission of the Department, Program Objectives, Program Outcomes and Program Specific Outcomes are aimed. Program Educational Objectives describe the expected accomplishments of graduates during the first few years after graduation. Program Outcomes are statements that describe what students are expected to know and be able to perform by the time of graduation. Program Specific Outcomes describe expected outcomes of the B. Tech Program in

Electrical & Electronics Engineering at RVR&JC College of Engineering. These relate to skills, knowledge and behaviors the student acquire during their course of study.

The department has its own Library in addition to main Library. The department has obtained permission from Government of Andhra Pradesh to carry out consultancy Work to the Industries/Organizations in and around Guntur.

Faculty members of the Department are dedicated and have the vision to work for the welfare and prospect of the students. Slow learners are identified and suggestions & guidance is given by Faculty of the Department to improve their ability and overall performance apart from career guidance. The Department is proud to state that the Academic results are always above 95%. It is regular practice to the Department students to won top University ranks consistently in Electrical & Electronics Engineering since its inception.

Faculty motivates the students to take part in National level Quiz competitions, Workshops, Seminars, Group discussions, Design contests, Paper presentation contests and Poster presentations. Students are also encouraged to take part in NCC, NSS, Sports and various Cultural activities. The Department students are taken to short and long Industrial study tours to provide Industrial exposure.

The department in association with IEEE student branch, ISTE chapter and EEE students Association (RAJEEA) organizes activities like quiz, workshops, seminars, Group discussion, paper contests and poster presentations etc. Every student of Electrical & Electronics Engineering will become a member of RVR&JC Electrical & Electronics Engineering Association (RAJEEA).

The students are trained and coaching is given to appear GRE, TOEFL, IES, GATE and Public sector examinations. Special emphasis is given on improvement of Professional skills, Communication skills and Entrepreneur skills. To enhance the Employability skills and to promote the entrepreneurship in synchronization with the industrial growth training is given to the students with the help of APSSDC skill development centre. Campus interviews are arranged through placement cell of RVR & JC College of Engineering. The Alumni of EEE Department spread throughout the world and serving to the needs of the society.

R.V.R. & J.C. COLLEGE OF ENGINEERING :: GUNTUR
(Autonomous)

REGULATIONS (R-18) FOR
Four Year BACHELOR OF TECHNOLOGY (B.Tech.) Degree Program

(w.e.f. the batch of candidates admitted into First Year B.Tech. from the academic year 2018-2019).

1 MINIMUM QUALIFICATIONS FOR ADMISSION

A candidate seeking admission into First Year of B.Tech. Degree Program should have passed either Intermediate examination conducted by the Board of Intermediate Education, Andhra Pradesh with Mathematics, Physics, and Chemistry as optional subjects (or any equivalent examination recognized by the Acharya Nagarjuna University) or A candidate seeking admission into Second Year of B.Tech. Degree Program should have passed either Diploma in Engineering in the relevant branch conducted by the State Board of Technical Education & Training of Andhra Pradesh (or equivalent Diploma recognized by Acharya Nagarjuna University).

The selection is based on the rank secured by the candidate at the EAMCET / ECET (FDH) examination conducted by A.P. State Council of Higher Education. The candidate shall also satisfy any other eligibility requirements stipulated by the University and / or the Government of Andhra Pradesh from time to time.

2 BRANCHES OF STUDY

The B.Tech. Course is offered in the following branches of study:

1. Computer Science & Business Systems
2. Chemical Engineering
3. Civil Engineering
4. Computer Science & Engineering
5. Electrical & Electronics Engineering
6. Electronics & Communication Engineering
7. Information Technology
8. Mechanical Engineering

3 DURATION OF THE COURSE AND MEDIUM OF INSTRUCTION

3.1 The duration of the course is Four academic years consisting of two semesters in each academic year. The medium of instruction and examination is English.

3.2 The duration of the course for the candidates (Diploma Holders) admitted under lateral entry into Second Year B.Tech. is Three academic years consisting of two semesters in each academic year. The medium of instruction and the examination is English.

4 MINIMUM INSTRUCTION DAYS

Each semester shall consist of a minimum number of 90 days of instruction excluding the days allotted for tests, examinations and preparation holidays.

5 REGISTERING THE COURSES

5.1 A candidate has to register and secure 160 credits which include laboratory courses and project work. However, the candidate admitted under lateral entry has to register and secure 122 credits, which includes laboratory courses and project work.

5.2 A candidate has to register and secure at least minimum pass grade in Mandatory Courses, for which no credits are awarded.

5.3 A candidate has to secure at least minimum pass grade in Value Added Courses offered by the individual departments, for which no credits are awarded.

5.4 MOOCS (Massive Open Online Course):

- Enrolment of MOOCs courses of 12 weeks duration (421-Professional Elective & 422-Open Elective) will be initiated from the date of commencement of class work for Semester VI [Third Year] from the list of organisations offering MOOCS course(s) announced by the respective Board of Studies / Head of Departments and courses completion certificate must be submitted on or before the last instruction day of Semester VIII [Fourth Year].

- However, a student can register and complete more no. of MOOCs course(s) of his/her interest and must submit the completion certificate(s) on or before the last instruction day of Semester VII [Fourth Year], which will be reflected in the consolidated grade sheet.

5.5 Internship / Certification / Industrial Training (4 weeks in two spells) :

- Enrollment of Internship / Industrial Training will be initiated at the end of Semester IV [Second Year] and Semester VI [Third Year].
- Internship / Industrial Training completion certificate(s) must be submitted on or before the last instruction day of Semester VII [Fourth Year].

6 EVALUATION

The performance of the candidates in each semester shall be evaluated Course wise.

6.1 The distribution of marks between Sessional Examination (based on internal assessment) and Semester End Examination is as follows:

Nature of the Courses	Sessional Marks	Semester End Exam. Marks
Theory Courses / Design and / or Drawing / Practicals	40	60
Mini Project / Term paper / Mandatory Course / Value Added Course	100	---
Project work	40	60 (Viva voce)

6.2 In each of the Semesters, there shall be two Mid Term examinations and two Assignment Tests in every theory course. The Sessional marks for the midterm examinations shall be awarded giving a weightage of 15 marks out of 18 marks (80% approx.) to that midterm examination in which the candidate scores more marks and the remaining 3 marks (20% approx.) for other midterm examination in which the candidate scores less marks. Similarly a weightage of 10 marks (80% approx.) out of 12 marks earmarked for assignment tests shall be given for the assignment in which the candidate scores more marks and remaining 2 marks (20% approx.) shall be given for the assignment test in which the candidate scores less marks.

A maximum of five marks are allotted for attendance in the respective theory courses in a graded manner as indicated in ***clause 8.2.*** The remaining 5 marks out of the 40 marks earmarked for the

sessional marks are awarded (quiz / online examination) by the concerned teacher in the respective theory courses.

6.3 The evaluation for Laboratory class work consists of a weightage of 25 marks for day to day laboratory work including record work and 15 marks for internal laboratory examination including Viva-voce examination.

In case of Project work, the sessional marks shall be awarded based on the day-to-day progress, the performance in two Seminars and the Project Report submitted at the end of the semester. The allotment of sessional marks for Seminars and day-to-day work shall be 15 and 25 respectively.

NOTE : A candidate who is absent for any Assignment / Mid Term Exam, for any reason whatsoever, shall be deemed to have scored zero marks in that Test / Exam and no make-up test / Exam shall be conducted.

6.4 A candidate who could not secure a minimum of 50% aggregate sessional marks is not eligible to appear for the Semester End Examination and shall have to repeat that Semester.

7 LABORATORY / PRACTICAL COURSES

In any semester, a minimum of 10 experiments / exercises specified in the syllabus for laboratory course shall be completed by the candidate and get the record certified by the concerned faculty and Head of the Department, to be eligible to face the Semester End Examination in that Practical course.

8 ATTENDANCE REGULATIONS

8.1 Regular course of study means a minimum average attendance of 75% in all the courses computed by totalling the number of hours / periods of lectures, design and / or drawing, practical's and project work as the case may be, held in every course as the denominator and the total number of hours / periods actually attended by the candidate in all the courses, as the numerator.

8.2 A weightage in sessional marks up to a maximum of 5 marks out of 40 marks in each theory course shall be given for those candidates who put in a minimum of 75% attendance in the respective theory in a graded manner as indicated below:

Attendance of 75% and above but less than 80%	- 2 mark
Attendance of 80% and above but less than 85%	- 3 marks
Attendance of 85% and above but less than 90%	- 4 marks
Attendance of 90% and above	- 5 marks

8.3 Condonation of shortage in attendance may be recommended on genuine medical grounds, up to a maximum of 10% provided the candidate puts in at least 65% attendance as calculated in ***clause 8.1***, provided the Principal is satisfied with the genuineness of the reasons and the conduct of the candidate. However, marks will not be awarded for condonation of shortage in attendance.

8.4 A candidate who could not satisfy the minimum attendance requirements in any semester as mentioned in ***clause 8.1***, is not eligible to appear for the Semester End Examinations and shall have to repeat the same Semester.

9 DETENTION

A candidate, who fails to satisfy either the minimum attendance requirements as stipulated in ***Clause-8***, or the requirement of minimum aggregate sessional marks as stipulated in ***Clause-6***, shall be detained. Such candidate shall have to repeat the same semester.

10 SEMESTER END EXAMINATION

10.1 For each theory course, there shall be a comprehensive Semester End Examination at the end of each Semester.

10.2 For each Practical course the Smester End Examination shall be conducted by one internal and one external examiner appointed by the Principal of the College, the duration being that approved in the detailed Schemes of Instruction & Examination.

10.3 Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner appointed by the Principal.

11 CONDITIONS FOR PASS

A candidate shall be declared to have passed in individual course if he / she secures a minimum of 35% marks in theory and 50% marks in Practical courses/drawing courses/Project Viva-voce in Semester End Examination and minimum of 40% marks in both Sessional & Semester End Examination put together.

12 AWARD OF CREDITS

12.1 Credits are awarded for each Theory Course / Practical Course and Project Work.

12.2 AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1	≥ 90	O	10.0
2	$\geq 80 - < 90$	A+	9.0
3	$\geq 70 - < 80$	A	8.0
4	$\geq 60 - < 70$	B+	7.0
5	$\geq 50 - < 60$	B	6.0
6	$\geq 40 - < 50$	C	5.0
7	< 40	F	0.0
8	The grade 'W' represents withdrawal / absent	W	0.0

12.3 A candidate securing 'F' grade in any course there by securing zero grade points has to reappear and secure at least 'E' grade in the subsequent examinations for that course.

12.4 A candidate who has earned 'F' grade in any course can repeat the course and can improve the internal marks by re-registering a maximum of TWO Subjects per semester. However, a student, who is not on rolls due to detention (not promoted to the next semester), can register a maximum of SIX subjects comprising of all semesters, put together.

12.5 After each semester, Grade sheet will be issued which will contain the following details:

- The list of courses for each semester and corresponding credits and grades obtained
- The Semester Grade Point Average (SGPA) for each semester and
- The Cumulative Grade Point Average (CGPA) of all courses put together up to that semester.

SGPA is calculated based on the following formula:

$$\frac{\sum [\text{ No. of Credits X Grade Points }]}{\sum \text{ No. of Credits}}$$

CGPA will be calculated in a similar manner, considering all the courses up to that semester.

12.6 A consolidated Grade Sheet shall be issued to the candidate, after completing all , indicating the CGPA of all the Four / Three years put together.

12.7 Conversion of CGPA into equivalent Percentage.: Percentage of Marks = 9.25 x CGPA

13 CONDITIONS FOR PROMOTION

13.1 A candidate shall be eligible for promotion to next semester, if he/she satisfies the minimum requirements of attendance and sessional marks as stipulated in ***Clauses 6 and 8***.

13.2 A candidate shall be eligible for promotion to Third Year, if he / she secures 26 credits (70% approx.) of the total number of credits (38) of First Year by the time the classwork commences for Third Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in Semester IV [Second Year].

13.3 A candidate shall be eligible for promotion to Fourth Year, if he / she secures a minimum of 70% of the total number of credits of First & Second Years put together, by the time the classwork commences for Fourth Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in Semester VI [Third Year].

S. No.	Branch	Total No. of Credits First & Second Years put together	Minimum No. of Credits required for promotion (70% approximately)
1	Computer Science & Business Systems	38+40 = 78	54
2	Chemical Engineering	38+40 = 78	54
3	Civil Engineering	38+46 = 84	58
4	Computer Science & Engineering	38+44 = 82	57
5	Electrical & Electronics Engineering	38+42 = 80	56
6	Electronics & Communication Engineering	38+45 = 83	58
7	Information Technology	38+44 = 82	57
8	Mechanical Engineering	38+44 = 82	57

13.4 A candidate (Diploma Holder) admitted under lateral entry into Second Year, shall be eligible for promotion to Fourth Year, if he/she secures a minimum of 70% of the total number of credits of Second Year by the time the classwork commences for Fourth Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in Semester VI [Third Year]

S. No.	Branch	Total No. of Credits in Second Year	Minimum No. of Credits required for promotion (70% approximately)
1	Computer Science & Business Systems	40	28
2	Chemical Engineering	40	28
3	Civil Engineering	46	32
4	Computer Science & Engineering	44	30
5	Electrical & Electronics Engineering	42	30
6	Electronics & Communication Engineering	45	31
7	Information Technology	44	30
8	Mechanical Engineering	44	30

14 ELIGIBILITY FOR AWARD OF B.TECH. DEGREE

The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements:

14.1 The candidate must have satisfied the conditions for pass in all the courses of all the years as stipulated in ***Clauses 11***.

14.2 Maximum Time Limit for completion of B.Tech Degree

A candidate, who fails to fulfil all the academic requirements for the award of the degree within eight academic years from the year of admission, shall forfeit his/her seat in B.Tech. course.

14.3 A candidate (Diploma Holder) admitted under lateral entry into Second Year B.Tech., who fails to fulfil all the academic requirements for the award of the degree within six academic years from the year of admission, shall forfeit his/her seat in B.Tech. course.

15 AWARD OF CLASS

A candidate who becomes eligible for the award of B.Tech. Degree as stipulated in ***Clause 12*** shall be placed in one of the following Classes.

S.No.	Class	CGPA
1	First Class With Distinction	8.0 or more
2	First Class	6.5 or more but less than 8.0
3	Second Class	5.5 or more but less than 6.5
4	Third Class	5.0 or more but less than 5.5

16 IMPROVEMENT OF CLASS

A candidate, after becoming eligible for the award of the Degree, may improve the CGPA by appearing for the Semester End Examination in any of the theory course as and when conducted. But this provision shall be within a period of two academic years after becoming eligible for the award of the Degree. However, this facility cannot be availed by a candidate who has taken the Original Degree Certificate.

17 AWARD OF RANK

The rank shall be awarded based on the following:

17.1 Ranks shall be awarded in each branch of study for the top five percent of the candidates appearing for the Regular Semester End Examinations or the top ten candidates whichever is minimum.

17.2 Only such candidates who pass the Final year examination at the end of the fourth/third academic year after admission as regular final year candidate along with others in their batch and become eligible for the award of the degree shall be eligible for the award of rank. The Rank will be awarded only to those candidates who complete their degree within four/three academic years.

17.3 For the purpose of awarding rank in each branch, only such candidates who passed all courses in the first attempt only shall be considered.

18 SUPPLEMENTARY EXAMINATIONS

18.1 In addition to the Regular semester end examinations held at the end of each semester,

supplementary examinations will also be conducted during the academic year. Such candidates taking the Regular / Supplementary examinations as supplementary candidates may have to take more than one examination per day.

18.2 Instant examination will be conducted immediately after the declaration of Semester VIII [Fourth Year] results for those candidates who cleared all courses except one course in Semester VIII [Fourth Year].

19 TRANSITORY REGULATIONS

A Candidate, who is detained or discontinued in the semester, on readmission shall be required to do all the courses in the curriculum prescribed for such batch of candidates in which the candidates joins subsequently.

19.1 A candidate, studied under R-16 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics/attendance at the end of the Semester II [First Year] or Semester III [Second Year], shall join in appropriate Semester of R-18 regulations. The candidate has to clear all the backlog subjects or equivalent subjects if any under R-18 curriculum by appearing the supplementary examinations, conducted by the college under R-18 curriculum. The class will be awarded based on the academic performance of the candidate as R-18 regulations.

19.2 A candidate, studied under R-16 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics / attendance at the end of the Semester IV [Second Year] and also at the subsequent semesters will follow the same R-16 regulations/curriculum and he/she has to complete all the courses by appearing in the examination conducted by the college under R-16 curriculum. The class will be awarded based on the academic performance of the candidate as per R-16 regulations.

19.3 A candidate, transferred from other institutions / universities into Semester II [Second Year] and also at the subsequent semesters of B.Tech., shall join at appropriate semester of R-18 curriculum. Such candidate shall study all the courses prescribed for that batch, in which, the candidate joins. The candidate has to clear the backlog courses, if any, in the semesters which he/she has studied in the earlier institutions / universities by appearing the supplementary examinations conducted by the college in R-18 circulum courses / equivalent courses. The equivalent courses will be decided by concerned Board of Studies.

20 CONDUCT AND DISCIPLINE

20.1 Candidates shall conduct themselves within and outside the premises of the institute in a manner befitting the candidates of our institution.

20.2 As per the order of Honourable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.

20.3 The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

a Lack of courtesy and decorum, indecent behaviour anywhere within or outside the campus.

b Wilful damage of college / individual property

c Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

d Mutilation or unauthorized possession of library books.

e Noisy and unseemly behaviour, disturbing studies of fellow candidates.

f Hacking of computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber-crime etc.)

g Usage of camera / cell phone in the

campus h Plagiarism of any nature

i Any other acts of gross indiscipline as decided by the academic council from time to time.

20.4 Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debar from examination, disallowing the use of certain facilities of the institute, rustication for a specified period or even outright expulsion from the institute or even handing over the case to appropriate law enforcement or the judiciary, as required by the circumstances.

20.5 For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief warden, the head of the department and the principal respectively, shall have the authority to reprimand or impose fine.

20.6 Cases of adoption of unfair means and / or any malpractice in an examination shall be reported to the principal for taking appropriate action.

20.7 All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.

20.8 The institute level standing disciplinary action committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

20.9 The principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the programmes committee in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved by the appropriate authority, shall be reported to the academic council for ratification.

20.10 "Grievance and Redressal Committee" (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.

21 MALPRACTICES

21.1 The Principal shall refer the cases of malpractices in internal assessment tests and semester-end examinations to a malpractice enquiry committee constituted by him / her for the purpose. Such committee shall follow the approved scales of punishment. The principal shall take necessary action, against the erring candidates basing on the recommendations of the committee.

21.2 Any action on the part of a candidate during an examination trying to get undue advantage or trying to help another, or drive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the staff, who are in-charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing

incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned in the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

22 AMENDMENTS TO REGULATIONS

The College may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabus.

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B.TECH ELECTRICAL & ELECTRONICS ENGINEERING

(w.e.f. the batch of students admitted from the academic year 2018-2019)

Three Weeks Orientation Programme is Mandatory before starting SEMESTER I (First Year)

SEMESTER I (First Year) **COURSE STRUCTURE**

S.No.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EE111	Mathematics-I	3	1	-	40	60	4	BS
2	EE/EC/ ME 112	Engineering Chemistry	3	1	-	40	60	4	BS
3	EE/CE/ ME 113	English for communication skills	2	-	-	40	60	2	HS
4	EE/EC/ ME 151	Chemistry Lab	-	-	3	40	60	1.5	BS
5	EE/CE/ ME 152	English Language Communication Skills Lab	-	-	2	40	60	1	HS
6	EE/CE/ ME 153	Workshop Practice Lab	1	-	4	40	60	3	ES
7	MC001	Constitution of India	2	-	-	100	-	-	MC
8	MC002	Environmental Science	2	-	-	100	-	-	MC
9	MC003	Essence of Indian traditional knowledge	2	-	-	100	-	-	MC
		TOTAL	15	2	9	540	360	15.5	TPW-26

SEMESTER II (First Year) **COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EE121	Mathematics-II	3	1	-	40	60	4	BS
2	EE122	Engineering Physics	3	1	-	40	60	4	BS
3	EE/CE/ CH/CS/ EC/IT/ ME 123	Programming for Problem Solving	3	-	-	40	60	3	ES
4	EE124	Electrical Circuits	3	1	-	40	60	4	ES
5	EE161	Physics Lab	-	-	3	40	60	1.5	BS
6	EE/CE/ CH/CS/ EC/IT/ ME 162	Programming for Problem Solving Lab	-	-	4	40	60	2	ES
7	EE/CE/ ME 163	Engineering Graphics & Design Lab	1	-	4	40	60	3	ES
8	EE164	Electrical Circuits Lab	-	-	2	40	60	1	ES
		TOTAL	13	3	13	320	480	22.5	TPW-29

SEMESTER III (Second Year) **COURSE STRUCTURE**

S.No.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EE211	Electrical Circuit Analysis	3	-	-	40	60	3	PC
2	EE212	Electronic Devices & Circuits	3	-	-	40	60	3	PC
3	EE213	DC Machines	3	-	-	40	60	3	PC
4	EE214	Electromagnetic Fields	3	-	-	40	60	3	PC
5	EE215	Basic Civil & Mechanical Engineering	3	-	-	40	60	3	ES
6	EE216	Digital Electronics	3	-	-	40	60	3	PC
7	EE251	Electronic Devices & Digital Electronics Lab	-	-	2	40	60	1	PC
8	EE252	DC Machines Lab	-	-	2	40	60	1	PC
9	EE253	Basic Civil & Mechanical Engineering Lab	-	-	2	40	60	1	ES
		TOTAL	18	-	6	360	540	21	TPW-24

SEMESTER IV (Second Year) **COURSE STRUCTURE**

S. No.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EE221	Mathematics – III	3	1	-	40	60	4	BS
2	EE222	Life sciences for Engineers	2	-	-	40	60	2	BS
3	EE223	Electronic Circuit Analysis	3	-	-	40	60	3	PC
4	EE224	AC Machines	3	-	-	40	60	3	PC
5	EE225	Electrical Power generation	2	1	-	40	60	3	PC
6	EE226	Open Elective – I [DS & Algorithms]	3	-	-	40	60	3	OE
7	EE261	AC Machines Lab	-	-	2	40	60	1	PC
8	EE262	Pulse and Digital circuits Lab	-	-	2	40	60	1	PC
9	EE263	Communicative English Lab	-	-	2	40	60	1	HS
10	MC004	Design thinking & product innovation	2	-	-	100	-	-	MC
		TOTAL	18	2	6	460	540	21	TPW-26

SEMESTER V (Third Year) **COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EE311	Control Systems	3	-	-	40	60	3	PC
2	EE312	Microprocessors & Microcontrollers	3	-	-	40	60	3	PC
3	EE313	Synchronous & Special Machines	3	-	-	40	60	3	PC
4	EE314	Transmission & Distribution	3	-	-	40	60	3	PC
5	EE315	Professional Elective – 1	3	-	-	40	60	3	PE
6	EE316	Open Elective-2	3	-	-	40	60	3	OE
7	EE351	Control Systems Lab	-	-	2	40	60	1	PC
8	EE352	Microprocessors & Microcontrollers Lab	-	-	2	40	60	1	PC
9	EE353	Synchronous & Special Machines Lab	-	-	2	40	60	1	PC
		TOTAL	18	-	6	360	540	21	TPW-24

SEMESTER VI (Third Year) **COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EE321	Power Electronics	3	-	-	40	60	3	PC
2	EE322	Measurements and Instrumentation	3	-	-	40	60	3	PC
3	EE323	Linear ICs and Applications	3	-	-	40	60	3	PC
4	EE324	Power system analysis & stability	3	-	-	40	60	3	PC
5	EE325	Professional Elective – 2	3	-	-	40	60	3	PE
6	EE326	Humanities Elective – 1	3	-	-	40	60	3	HE
7	EE361	Power Electronics Lab	-	-	2	40	60	1	PC
8	EE362	Measurements and Instrumentation Lab	-	-	2	40	60	1	PC
9	EE363	Electronics Design Lab	1	-	2	40	60	2	PC
		TOTAL	19	-	6	360	540	22	TPW-25

SEMESTER VII (Fourth Year) **COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EE411	Industrial drives	3	-	-	40	60	3	PC
2	EE412	Computer Aided power systems analysis	3	-	-	40	60	3	PC
3	EE413	Professional Elective – 3	3	-	-	40	60	3	PE
4	EE414	Professional Elective – 4	3	-	-	40	60	3	PE
5	EE415	Humanities Elective – 2	3	-	-	40	60	3	HE
6	EE416	Open Elective - 3	3	-	-	40	60	3	OE
7	EE451	Power Systems Lab	-	-	2	40	60	1	PC
8	EE452	Simulation Lab	-	-	2	40	60	1	PC
9	EE453	Project Stage – 1	-	-	4	100	--	2	PR
10	EE454	Summer Internship	-	-	-	100	--	2	PR
		TOTAL	18	-	8	520	480	24	TPW-26

SEMESTER VIII (Fourth Year) **COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EE421	Professional Elective – 5 / MOOCS	3	-	-	-	100	3	PE
2	EE422	Open Elective – 4 / MOOCS	3	-	-	-	100	3	OE
3	EE461	Project Stage – II	-	-	14	40	60	7	PR
		TOTAL	6	-	14	40	260	13	TPW-14+6

Total credits: 160

Professional Elective Courses	
EEEL01	Signals and systems
EEEL02	New & Renewable Energy resources
EEEL03	Power system protection
EEEL04	Power system operation & control
EEEL05	Utilization of Electrical Power
EEEL06	Advanced Electric Drives
EEEL07	Electrical Distribution systems
EEEL08	Wind and Solar Energy Systems
EEEL09	Electrical Machine Design
EEEL10	HVDC Transmission Systems
EEEL11	Power Quality
EEEL12	Flexible AC Transmission Systems
EEEL13	High Voltage Engineering
EEEL14	Electrical Energy Conservation and Auditing
EEEL15	Power System Dynamics and Control
EEEL16	Line-Commutated and Active PWM Rectifiers
EEEL17	Industrial Electrical Systems
EEEL18	Smart Electric grids
EEEL19	Digital Control Systems
EEEL20	Control Systems Design
EEEL21	Digital Signal Processing
EEEL22	Computer Architecture
EEEL23	Electromagnetic waves

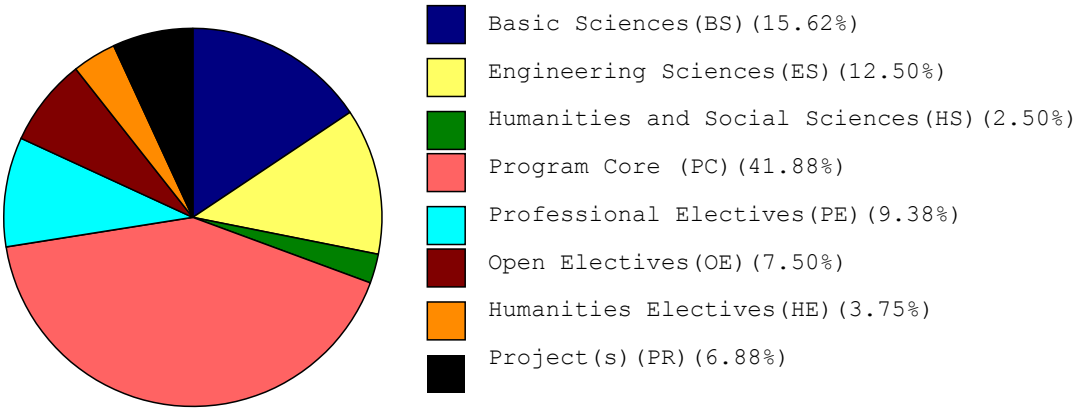
EEEL24	Computational Electromagnetics
EEEL25	Power system Deregulation
Open Elective Courses Offered by EEE Department	
EEOL1	Renewable energy sources
EEOL2	Utilization of Electrical Energy
EEOL3	Power Converters
EEOL4	Energy Conservation
EEOL5	Electric Vehicles
	HS Electives
HSEL01	Industrial Management & Entrepreneurship
HSEL02	Economics for Engineers
HSEL03	Introduction to Industrial Management
HSEL04	Project Management & Entrepreneurship
HSEL05	Human Resources & Organisational Behavior
HSEL06	Ethics & Human Values
	Open Elective Courses Offered by other departments
CEOL01	Building Materials and Construction
CEOL02	Solid waste Management
CEOL03	Remote Sensing and GIS
CHOL01	Energy Engineering
CHOL02	Biofuels
CHOL03	Pollution Control
CHOL04	Nanoscience and Nanotechnology
CSOL01	Programming with Java
CSOL02	Relational Database Management Systems
CSOL03	Introduction to Python Programming
CSOL04	Internet of Things
ECOL01	Applied Electronics
ECOL02	Basic Communication
ECOL03	Basic Electronics & Communication Engineering
ECOL04	Microprocessors & Interfacing
ECOL05	Digital Image Processing
ITOL01	Data Structures & Algorithms
ITOL02	Operating Systems
ITOL03	Big Data Analytics
ITOL04	Web Technologies
MEOL01	Automotive Engineering
MEOL02	Robotic Engineering
MEOL03	Introduction to Operations Research
MEOL04	Mechatronics
MEOL05	Applied Mechanics & Mechanical Engineering
	Value Added Courses
EEV 01	English competency development program
EEV 02	AI Tools, Techniques and Applications
EEV 03	Electric Vehicle Technology
EEV 04	Professional English

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

B.TECH. ELECTRICAL & ELECTRONICS ENGINEERING

Program curriculum grouping based on course components

Course Component	Curriculum Content (% of total number of credits program)	Total number of contact hours	Total number of credits
Basic Sciences (BS)	15.62	28	25
Engineering Sciences (ES)	12.5	28	20
Humanities and Social Sciences (HS)	2.5	6	4
Professional Core (PC)	41.88	78	67
Professional Electives (PE)	9.38	15	15
Open Electives (OE)	7.5	12	12
Humanities Electives (HE)	3.75	6	6
Project(s) (PR)	6.88	18	11
Mandatory Course(s) (MC)	--	8	--
Total number of Credits			160



EE 111 :: MATHEMATICS-I

(Matrix Theory, Calculus & Differential Equations)

Semester I [First Year]

L	T	P	C	Int	Ext
3	1	0	4	40	60

COURSE OBJECTIVES:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and differential equations. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Find the matrix eigenvalues, and obtain the tool of power series and Fourier series for learning advanced Engineering Mathematics.
2. Evaluate multiple integrals and their usage.
3. Understand concepts like divergence, curl and integration of vector function.
4. Solve differential equations which model physical processes.

UNIT I [CO:1] (15)

Characteristic equation, Eigenvalues and eigenvectors, Cayley-Hamilton theorem (without proof), diagonalization of matrices, reduction of quadratic form to canonical form. Sequences, Series, Series of positive terms, Convergence tests : Comparison test (limit form) D'Alembert's ratio test, Raabe's test for convergence. Fourier series : Half range sine and cosine series, Parseval's formula.

UNIT II [CO:2] (15)

Evolutes and Involutes, Evaluation of improper integrals : Integrals without infinite limits of integration, Multiple Integrals: Double integrals (Cartesian and polar), change of order of integration, change of variables (Cartesian to polar), Area by double integration, triple integrals, volume by triple integrals, Beta and Gamma functions.

UNIT III [CO:3] (15)

Scalar and vector point functions, Gradient, directional derivative, divergence and curl, del applied twice to point and product of point functions (without proofs).

Vector integration: line integral, surface and volume integrals, Green's theorem (without proof), Stoke's theorem (without proof), Gauss divergence theorem (without proof).

UNIT IV [CO:4] (15)

First order ordinary differential equations : Linear, Bernouli and exact equations. Second order ordinary linear equations : Solution by method of variation of parameters Cauchy's homogeneous equation, Legendre's linear equation.

First order partial differential equations: Solution of first order linear and non linearPDE's (Charpit's method).

LEARNING RESOURCES:

TEXT BOOK:

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

REFERENCE BOOK(s):

1. G.B. Thomas and R.L. Finney - Calculus and Analytic geometry, Pearson, 2002.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.
3. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons, 2006.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EE/EC/ME 112 – ENGINEERING CHEMISTRY
Semester I / II [First Year]

L	T	P	C	Int	Ext
3	1	0	4	40	60

COURSE OBJECTIVES:
1. To impart concepts involved in molecular structure and intermolecular forces.
2. To Understand the chemistry behind electrochemical energy systems.
3. To understand the chemical concepts involved in Water treatment and Corrosion.
4. To understand the about the major organic reactions and end products like conducting polymers.
5. To learn the analytical methods useful in characterization of compounds.

COURSE OUTCOMES:
After successful completion of the course, the students are able to
1. identify stable complexes and suitable electrochemical energy systems for end usage.
2. apply his knowledge for effective water treatment and corrosion prevention.
3. identify chemical reactions that are used in the synthesis of molecules and polymers
4. distinguish the ranges of the electromagnetic spectrum and characterize a given compound using analytical techniques

Course Content:

UNIT-I: Molecular structure, Intermolecular forces and Energy systems 15 Hrs.

Crystal field theory-salient features, energy level diagrams-tetrahedral and octahedral complexes, crystal field stabilization energies and magnetic properties.

Ionic, dipolar, Vander Waal's interaction and Hydrogen bonding, critical phenomena-Andrew's isotherms of CO_2, derivation of critical constants from Vander Waal's equation.

Electrode potential, electrochemical series, Nernst equation and its applications. Batteries-Primary (Dry cell) and secondary (Lead acid), Lithium battery (Li-MnO_2)- advantages, Fuel cell (H_2-O_2 cell).

UNIT-II: Water Chemistry and Corrosion 15 Hrs.

Water Chemistry-WHO standards, Municipal water treatment-Removal of suspended impurities-Sedimentation, Co-agulation and Filtration-Disinfection of water by chlorine, Break point chlorination, Dechlorination, Purification by ion-exchange method and reverse osmosis.

Corrosion-Introduction, Electrochemical theory of corrosion, galvanic corrosion, differential aeration corrosion, Factors-temperature, pH, overvoltage. Cathodic protection by sacrificial anodic method and impressed current method. Electroplating (Cu), Electrolessplating (Ni).

UNIT-III: Organic reactions and Polymers 15 Hrs.

Types of organic reactions-Substitution (SN_1 and SN_2), Elimination (E_1 and E_2), Addition-Markownikoff's rule and anti-Markownikoff's rule, Cyclisation (Diel's Alder reaction), Synthesis of aspirin.

Polymers-Functionality, Degree of Polymerization, Tacticity-Addition and condensation polymerization, Relationship between Structure and Properties of polymers (Strength, Crystallinity, Elasticity, Plastic Deformation, Glass transition temperature (T_g)), Factors affecting T_g.

Conducting polymers: Introduction, Examples, General applications, Mechanism of conduction in polyacetylene.

UNIT-IV: Spectroscopic techniques and its applications **15 Hrs.**

Beer-Lambert's law, limitations, colorimetric determination of Fe(III) UV-VIS spectroscopy – electronic transitions, shifts-blue and red, Block diagram - brief introduction of components, Applications – purity and differentiation of conjugated and non-conjugated dienes.

IR Spectroscopy–condition to be IR active, vibrational modes of–AB_2, Block diagram-brief introduction of components, IR spectrum of CO_2 and H_2O molecules, General applications. Fluorescence and its applications in medicine.

LEARNING RESOURCES:

Text Books:

1. P.C.Jain and Monica Jain- Engineering chemistry, 16th edition, Dhanpat Rai Publishing Company.
2. Wiley Engineering chemistry, 2nd edition, Wiley India Private Limited.

Reference Books:

1. Bruce H. Mahan, University Chemistry, 3rd edition, Narosa Publishing House..
2. Shashi Chawla - A text book of Engineering chemistry, 3rd edition, Dhanpat Rai Publishing Company.

Web References:

1. Engineering Chemistry (NPTEL Web Book by B.L. Tembe, Kamaluddin & M.S. Krishnan)
2. http://www.powerstream.com/BatteryFAQ.html#lec
3. http://freevideolectures.com/Course/3029/Modern-Instrumental-Methods-ofAnalysis.

CE/EE/ME 113 & CH/CS/IT/EC 123 :; ENGLISH FOR COMMUNICATION SKILLS

Semester I / II [First Year]

L	T	P	C	Int	Ext
2	0	0	2	40	60

Course Objectives:

To enable students improve their lexical and communicative competence and to equip students with oral and written communication skills.
To help students understand and learn the correct usage and application of Grammar principles.
To get them acquainted with the features of successful professional communication.
To enable students acquire various specific features of effective written communication.

Course Outcomes:

After successful completion of the course, the students are able to

- Use vocabulary contextually.
- Compose effectively the various forms of professional communication.
- Apply grammar rules efficiently in spoken and written forms.
- Improve clarity to locate and learn the required information.

UNIT-I **[CO:1]** **[10]**

Vocabulary Building

1.1 - Root words from foreign languages and their use in English
1.2 - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.3 -Synonyms, antonyms, and standard abbreviations.
1.4 - One word substitutes.

UNIT-II **[CO:1,2,3]** **[10]**

Writing Skills

2.1- Proposal writing
2.2- Letter-writing
2.3- Techniques for writing precisely (précis writing)
2.4- E-mail writing

UNIT-III **[CO: 3]** **[10]**

Identifying Common Errors in Writing

3.1- Subject-verb agreement
3.2- Noun-pronoun agreement
3.3- Articles
3.4- Prepositions
3.5- Tenses
3.6- Redundancies

UNIT-IV **[CO:1,2,3,4]** **[10]**

Nature and Style of sensible Writing

4.1 - Description & Narration (Paragraph Writing). [CO:1,2,3]
4.2 - Essay Writing (Expository Essay). [CO:1,2,3]
4.3 - Note-Making and Note-Taking. [CO:1,2,4]
4.4 - Methods of preparing notes. [CO:1,2,4]

Learning Resources:

Text Book:

1. Communication Skills. Sanjay Kumar and Pushpa Lata.Oxford University Press.

References:

1. Remedial English Grammar. F.T. Wood. macmillan.2007
2. On Writing Well. William Zinsser. Harper ResourceBook. 2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasly.Cambridge University Press.2006.
4. Practical English Usage.Michael Swan. OUP. 1995Press

EE/EC/ME 151 :: CHEMISTRYLAB
Semester I / II [First Year]

L	T	P	C	Int	Ext
0	0	3	1.5	40	60

Course Objectives:

1. To learn concepts of equivalent weight, molecular weight, normality, molarity, weight and volume percent.
2. To know the methods of determining hardness and chloride ion content of water sample.
3. To learn the redox methods to determine Fe^{2+} ions present in solution.
4. To know principles and methods involved in using instruments like conductivity bridge and potentiometer
5. To know the molecular properties like surface tension, viscosity.
6. To know synthetic methods for preparation of drugs and polymer

Course outcomes:

After successful completion of the course, the students will be able to

1. Estimate the Fe(II) content of a given solution and chloride/hardness content of water.
2. Measure molecular properties such as surface tension, viscosity.
3. Measure conductance of solutions, redox potentials of a cell.
4. Synthesize a small drug molecule and polymer.

List of Experiments:

1. Estimation of Mohr's salt using $KMnO_4$.
2. Estimation of Mohr's salt using $K_2Cr_2O_7$.
3. Determination of chloride ion content of water.
4. Determination of Hardness of water using EDTA method.
5. Determination of Fe(II) strength using $K_2Cr_2O_7$ potentiometrically.
6. Determination on strength of NaOH using HCl conductometrically.
7. Determination of surface tension.
8. Determination of Viscosity.
9. Determination of Saponification / acid value of oil.
10. Preparation of p-bromo acetanilide.
11. Preparation of Phenol Formaldehyde resin.
12. Determination of partition co-efficient of I_2 in water.
13. Determination of R_f value using TLC.
14. Verification of Freundlich isotherm using adsorption of acetic acid on activated charcoal.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EE/CE/ME 152 :: ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

Semester I / II [First Year]

L	T	P	C	Int	Ext
0	0	2	1	40	60

Course Objectives:

1. To Identify speaker's purpose and tone; make inferences and predictions about spoken discourse, discuss and respond to content of a lecture or listening passage orally and/or in writing.
2. To Acquaint the students with the Standard English pronunciation, i.e., Receive Pronunciation (RP), with the knowledge of stress and intonation.
3. To Develop production and process of language useful for social and professional life.
4. To develop in them communication and social graces necessary for functioning. Improve the dynamics of professional presentations.
5. To develop critical reading and comprehension skills at different levels.

Course Outcomes:

After successful completion of the course, the students will be able to:

1. Comprehend relationships between ideas and make inferences and predictions about spoken discourse.
2. Speak English with a reasonable degree of accuracy in pronunciation.
3. Develop appropriate speech dynamics in professional situations.
4. Use effective strategies and social graces to enhance the value of communication.
5. Develop effective communication and presentation skills and using language effectively to face interviews with success.

Oral Communication

(This unit involves interactive practice sessions in Language Lab)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Interviews
5. Formal Presentations
6. Reading Comprehension

Learning Resources:

References:

(i) *Communication Skills*. Sanjay Kumar and Pushpa Lata. Oxford University Press.
(ii) *Practical English Usage.* Michael Swan. OUP. 1995 Press
(iii) *Exercises in Spoken English.* Parts.I- III. CIEFL, Hyderabad. Oxford University
(vi) Technical English .M. Sambaiah, Wiley Publications, New Delhi

CE/EE/ME 153 & CH/CS/EC/IT 163
WORKSHOP PRACTICE LAB (THEORY & LAB)
Semester I / II [First Year]

L	T	P	C	Int	Ext
1	0	4	3	40	60

Course Objectives:

Engineers, whatever be their line of activity, must be proficient with all aspects of manufacturing, however it should not be forgotten that practice without theory is blind and the theory without practice is lame.

1. Students involved in acquiring manufacturing skills must have balanced knowledge of theory as well as practice.
2. Imparts basic knowledge of various tools and their use in different sections of manufacture such as fitting, carpentry, tin smithy, moulding, casting, welding, electrical wiring, PCB work on electronic circuits and practice with machine shop tools & equipments.

Learning Out Comes:

After successful completion of the course, the students will be able to

1. Gain knowledge of the different manufacturing processes which are commonly employed in the industry to fabricate components using different materials.

Detailed Contents

Lectures and Videos: **[10]**

1. Manufacturing Methods: Introduction to various types of manufacturing methods –casting - forming - various machining operations such as turning, milling, shaping, drilling, slotting etc.,, - various joining methods such as welding, brazing, soldering etc.,- Advanced manufacturing methods(3 Lectures).
2. CNC machining and Additive manufacturing(1 Lecture)
3. Fitting operations and power tools (power hack saw, table mounted circular saw, wood turning lathe, bench grinder, concrete mixer, concrete vibrator etc.,) (1 Lecture)
4. Basic principles involved in electrical circuits and electronic PCB circuits(1 Lecture)
5. Carpentry(1 Lecture)
6. Welding(arc welding & gas welding)(1 Lecture)
7. Metal casting(1 Lecture)
8. Plastic moulding, glass cutting(1 Lecture)

Text books:

1. Hajra Choudhury S, K., Hajra Choudhury A.K and Nirjhar Roy S.K., "Elements of Workshop Technology", VolumeI and Volume II,2010, Media promoters and publishers private limited, Mumbai.

Reference books:.

1. Kalpakjian S and Steven S.Schmid.,"Manufacturing Engineering and Technology" 4th edition, Pearson Education, India, 2002.
2. Rao P.N., "Manufacturing Technology", Volume I &II, Tata McGrawHill House, 2017

Work shop Practice: **[60]**

Objectives:

Students acquiring practical knowledge on various manufacturing techniques and will be able to fabricate components with their own hands.

Outcomes:

Up on completion of laboratory, students will be able to gain the manufacturing skills and get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

List of Exercises - Trade wise Experiments:

1. Welding shop(both arc &gas welding)

- Square butt joint
- Lap joint

- Single v butt joint
- Gas welding & Cutting

2. Fitting Shop& Casting

- Inclined fit
- Half round fit
- V fit
- Moulding and casting of Hand wheel

3. Practice on electrical wiring and Electronic circuit boards

- One bulb controlled by one switch &one bulb controlled by two switches
- Two bulbs controlled by one switch (Stair case connection)
- Tube light connection
- Measurement of resistance, voltage and current with the help of a multi-meter & soldering on an electronic PCB circuit.

4. Machine Shop

- Practice of machining operations on Lathe, Milling, Shaping, Drilling and Slotting Machines.

5. Carpentry

- Lap joint
- Cross lap joint
- Dovetail joint
- Turning on wood turning Lathe

6. Tin Smithy

- Rectangular tray
- Funnel
- Pipe joint
- Rectangular Scoop

Plastic moulding and glass cutting

Note: A minimum of 2 (Two) from each trade - Total 12 (Twelve) experiments - have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

Text book:

P.Kannaiah, K.L.Narayana., Workshop Manual, Second Edition, Scitech Publications (INDIA) Pvt.Ltd.

EE 121 :: MATHEMATICS–II
(Transform Calculus and Numerical Methods)
Semester II [First Year]

L	T	P	C	Int	Ext
3	1	0	4	40	60

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in transform calculus and numerical methods. It aims to equip the students with standard concepts and tools of integral transforms and numerical techniques that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes:

The students will be able to:

- find Laplace and inverse transforms of a function.
- know how integral transforms can be used in engineering.
- solve system of equations numerically.
- know how to apply numerical methods in the mathematical models.

UNITI: **[15]**

Laplace transforms – Introduction, properties of Laplace transforms, Evaluation of integrals by Laplace transforms, Laplace transform of periodic function.

Inverse Laplace transforms – Method of partial fractions, other method of finding inverse transforms - $tf(t) = L^{-1}\left[-\frac{d}{ds}F(s)\right]$, Convolution theorem.

UNIT II: **[15]**

Applications to differential equations – Solving second order ordinary differential equations with constant coefficients using Laplace transforms.

Fourier transforms – Fourier transforms, Fourier sine and cosine transforms and inverse transforms.

UNITIII: **[15]**

Numerical solution of equations – Newton Raphson method, Gauss-Seidal method. Finite differences – Forward and backward differences, differences of a polynomial. Interpolation–Newton's forward and backward interpolation formulae (without proof),

Lagrange's interpolation formula (without proof), inverse interpolation. Numerical differentiation –Finding first and second order derivatives using Newton's forward and backward differences formulae.

UNIT IV: **[15]**

Numerical Integration – Trapezoidal rule and Simpson's one third rule. Numerical solution of first order ordinary differential equations–Taylor's series method, Euler's method, Runge-Kutta method of fourth order.

Numerical solution of partial equations – Classification of second order equations, solutions of Laplace and Poisson's equations.

LEARNING RESOURCES:

TEXT BOOK:

1. B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition.

REFERENCE BOOKs:

1. Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007.
2. N.P. Bali and Manish Goyal – A text book of Engineering Mathematics, Lakshmi Publications.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EE 122 :: ENGINEERING PHYSICS

Semester II [First Year]

L	T	P	C	Int	Ext
3	1	0	4	40	60

Objectives:

1. To impart knowledge and understanding the basic principles of waves & oscillators.
2. To understand about basic phenomena of light waves, fundamentals of Lasers & its applications.
3. To understand wave particle duality, uncertainty principle etc. by learning the prerequisite quantum physics.
4. Introducing the concept of electron motion in periodic potentials and formation of P-N junction from the basics of semiconductors.

Course Outcomes:

After successful completion of the course, the students are able to

1. Identify and illustrate physical concepts and terminology used in waves & oscillations.
2. The optical phenomena such Interference, diffraction, basics concepts of lasers and their applications
3. Some of the basic laws related to quantum mechanics such as wave particle duality, uncertainty principle, Schrodinger wave equation & its applications etc.
4. Basic concepts in physics of solids & semiconductors.

UNIT-I:

Waves & Non-dispersive transverse and longitudinal waves in one dimension [15]

Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator.

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their Eigen frequencies, longitudinal waves and the wave equation for them.

UNIT-II :

Wave Optics [15]

Interference& Diffraction: Interference in thin films(cosine law), Newton'srings (theory &derivation for diameter of the rings, Michelson interferometer(description & working) Fraunhofer diffraction from a single slit and a circularaperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction grating - theoryand its resolving power.

Lasers: Introduction to interaction of radiation with matter, Einstein's A&B coefficients. Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, spontaneous and stimulated emission. Population inversion, pumping, different types of lasers: solid-state laser (Nd:YAG),gas laser(He-Ne), applications of lasers.

UNIT-III: Introduction to Quantum Mechanics: [15]

Wave nature of Particles, Heisenberg's uncertainty principle-experimental verification electron diffraction-single slit), Time-dependent and time-independent Schrodinger equation forwave function, probability interpretation.

Solution of Wave Equation: Solution of stationary-state Schrodinger equation for one dimensional problems-particle ina box, linear harmonicoscillator, Scattering from a potential barrierand tunnelling (Qualitative treatment): relatedexamples likealphadecay, scanning tunnelingmicroscope.

UNIT-IV:

Introduction to Solids and Semiconductors: [15]

Failures of classical Free electron theory,quantum freeelectron theory (assumptions),Fermi –Dirac istribution function, Fermi level, density of energy states, Bloch's theorem for particles in a periodic potential, Kronig-Penney model (qualitative),effective mass of an electron.

Intrinsic and extrinsic semiconductors, Intrinsic charge carrier concentration(derivation), dependence ofFermi level on carrier-concentrationand temperature(equilibrium carrier statistics)(in brief), diffusion and drift currents, P-N junction(formation, energy level diagramand built in potential, I-V Characteristics).

Text Books:

M.N. Avadhanulu, P.G. Kshirasagar - A text book of Engineering Physics, 9th edition, S. Chand & Company Ltd., New Delhi, 2018.

References Books:

1. E.Hecht - Optics, Pearson Education, 2008.
2. A.Ghatak - Optics, McGraw Hill Education, 2012.
3. O.Svelto - Principles of Lasers, Springer Science & Business Media, 2010.
4. D.J.Griffiths - Quantum mechanics, Pearson Education, 2014.
5. R.Robinett - Quantum Mechanics, OUP Oxford, 2006.
6. D.McQuarrie - Quantum Chemistry, University Science Books, 2007.
7. Donald A.Neeman - Semiconductor Physics and Devices : Basic Principle (Fourth edition), TMH, 2012.
8. E.S.Yang - Microelectronic Devices, McGraw Hill, Singapore, 1988.
9. B.G.Streetman - Solid State Electronic Devices, Prentice Hall of India, 1995.
10. SL Kakani & Shubhra kakani - Engineering Physics, 3rd Edition, CBS Publications Pvt. Ltd., New Delhi.
11. I.G.Main - Vibrations and waves in physics, Cambridge University Press, 1993.
12. H.J.Pain - The Physics of vibrations and waves, Wiley, 2006.
13. Hitender K. Mallick, A.K.Singh - Engineering Physics:, McGraw Hill Education(India) Pvt. Ltd., New Delhi.

CH/CE/CS/EE/EC/IT/ME 123 - Programming for Problem Solving
Semester II [First Year]

L	T	P	C	Int	Ext
3	0	0	3	40	60

Course Objectives:

1. To understand the basic problem solving process using Flow Charts and algorithms.
2. To understand the basic concepts of control structures in C.
3. To learn concepts of arrays, functions, pointers and Dynamic memory allocation in C.
4. To use the concepts of structures, unions, files and command line arguments in C.

Course Outcomes:

After successful completion of the course, the students are able to

1. Develop algorithm and flowchart for simple problems.
2. Use suitable control structures and arrays for developing code in C.
3. Design modular structured programs using functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

Course Content:

Unit I **[15]**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: Steps to solve logical and numerical problems, Representation of Algorithm: Flowchart/Pseudocode with examples, from algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence.

Unit II: **[15]**

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching, Iteration and loops

Arrays: Arrays (1-D, 2-D), Character arrays and Strings

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations.

Unit III **[15]**

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series.

Unit IV **[15]**

Structure: Structures, Defining structures and Array of Structures

Pointers: Idea of pointers, Defining pointers, Use of Pointers in self referential structures.

File handling: Defining and opening a file, closing a file, input/output operations on files using file handling functions, random access to files.

Text Book:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. Programming in C by Stephen G. Kochan, Fourth Edition, Pearson
3. C Complete Reference, Herbert Sheildt, TMH., 2000.
4. Programming with C by K R Venugopal & Sudeep R Prasad, TMH., 1997.

Web References:

1. http://cprogramminglanguage.net/
2. http://lectures-c.blogspot.com/
3. http://www.coronadoenterprises.com/tutorials/c/c_intro.htm
4. http://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf

EE 124 - ELECTRICAL CIRCUITS
Semester II [First Year]

L	T	P	C	Int	Ext
3	1	0	4	40	60

Course Objectives:

1. To develop an understanding of the fundamental laws and elements of electrical circuits.
2. To develop the ability to apply circuit analysis to DC and AC circuits.
3. To understand transient and steady-state response of RLC circuits.

Course Outcomes:
After successful completion of the course, the student will be able to:

1. Outline the fundamental laws and elements of electrical circuits.
2. Solve problems on alternating current analysis and resonance.
3. Apply network theorems for the analysis of electrical circuits.
4. Obtain the transient and steady-state response of electrical circuits.

UNIT– I [Text Book 1&2] [15]
INTRODUCTION OF CIRCUIT ELEMENTS:
Basic definition of the unit of Charge, Voltage, Current, Power and Energy, Circuit concept, Active and Passive circuit elements; Ideal, Practical and dependent sources and their V-I characteristics, Source transformation, Voltage and Current division; V-I characteristics of Passive elements and their series / parallel combination; Star Delta transformation, Energy stored in Inductors and Capacitors, Kirchhoff's Voltage law and Kirchhoff's Current law. Mesh and Nodal Analysis.

UNIT– II [Text Book 1&2] [15]
INTRODUCTION TO ALTERNATING CURRENTS AND VOLTAGES:
Instantaneous, Peak, Average and RMS values of various waveforms; Crest factor, Form factor; Concept of phase and phase difference in sinusoidal waveforms; Phase relation in pure resistor, Inductor and capacitor; Impedance diagram, phasor diagram, series and parallel circuits, compound Circuits. Computation of active, reactive and complex powers; power factor.

UNIT –III [Text Book 1] [15]
NETWORK THEOREMS:
Superposition theorem, Thevenin's and Norton's theorems, Reciprocity, Compensation, Maximum power transfer theorems, Tellegan's and Millman's theorems, Application of theorems to DC circuits. Sinusoidal steady state Mesh and Node Analysis.Application of network theorems to AC circuits.

RESONANCE: Series resonance, Impedance and phase angle, voltages and currents, bandwidth and Q factor and its effect on bandwidth, magnification, parallel resonance, resonant frequency, variation of impedance with frequency , Q factor, magnification, reactance curves in parallel resonance.

UNIT– IV [Text Book1&2] [15]
Solution of First and Second order networks

Solution of first and second order differential equations for Series and parallel R-L, R-C, RLC circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for
standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions.
Learning Resources:

Text books:

1. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
2. A Sudhakar and Shyam Mohan SP, "Circuits and Networks: Analysis and Synthesis", TMH, 5th Edition, 2015.

Reference books:

1. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education,2004.
2. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
3. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
4. D. Roy Choudhury, "Networks and Systems", New Age International Publications,1998.

Web resources:

1. http://www.egate.ws/
2. http://cosmolearning.org/courses/circuit-theory/
3. http://www.nptelvideos.in/2012/11/circuit-theory.html
4. http://elearning.vtu.ac.in/P9/notes/06ES34/Unit1-KCV.pdf
5. http://pbtstudies.blogspot.in/

EE 161 :: PHYSICS LAB
Semester II [First Year]

L	T	P	C	Int	Ext
0	0	3	1.5	40	60

Course Objectives:

1. To give background in experimental techniques and to reinforce instruction in physical principles.
2. To find measurement, data, error, or graphical analysis in addition to illustrating a physical principle
3. To give skills that can transfer critical thinking into problem solving methods, how to identify what data is important, how to collect that data and then draw conclusions from it.

Course Outcomes:

After successful completion of the course, the students will be able to

1. use CRO, Function generator, Spectrometer for making measurements

2. test the optical instruments using principles of interference and diffraction

3. understand the concepts learned in the Physics theory.

4. carrying out precise measurements and handling sensitive equipment.

5. draw conclusions from data and develop skills in experimental design.

List of Experiments:

1) Some basic measuring instruments: Screw gauge, Vernier Callipers, Spherometer, Travelling Microscope etc., & General instructions.
2) To study the characteristic curves of a given Photocell and determine the Planck's constant.
3) To determine the radius of curvature of a given Plano-convex lens by Newton's Rings experiment.
4) To calculate the frequency & amplitude of sinusoidal waves and calibration of a given audio oscillator – Lissajous' Figures.
5) To determine the magnetic field along the axis of circular current carrying coil.
6) To measure the a.c. supply frequency using A.C. sonometer.
7) To determine the quality factor of a given series resonance LCR circuit.
8) To determine the specific resistance of a given wire by Carey- Foster's Bridge.
9) To determine Fill factor of a given photovoltaic cell.
10) To determine the energy band gap of a given semiconductor.
11) To determine the wavelengths of spectral lines of mercury light using diffraction grating.
12) To study the laser beam characteristics like wavelength using diffraction grating aperture divergence.
13) To determine the NA of a given optical fiber and hence to find the acceptance angle.
14) To find the dispersive power and resolving power of a grating.
15) To determine the magnetic field in Helmoltz coil.
16) To determine the refractive index of the material of a prism.
17) To determine the Four probe method apparatus for measurements of resistivity and conductivity.
18) To determine the rigidity modulus of the given wire material using Torsional pendulum.

Reference books:

1) Students reference manual : Department of physics, RVR & JC College of Engg.
2) Engineering Physics Lab Manual; Dr. C.V.Madhusudhana Rao, V. Vasanth Kumar, 3rd edition, Scitech publications(India) Pvt. Ltd. Chennai.
3) Engineering Physics Practicals: Dr.B. Srinivasa Rao, V.K.V.Krishna, K.S.Rudramamba University Science Press, Daryaganj, NewDelhi.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EE/CE/CH/CS/ EC/IT/ME 162 - Programming for Problem Solving Lab
Semester II [First Year]

L	T	P	C	Int	Ext
0	0	4	2	40	60

Course Objectives:

1. To understand the basic problem solving process using Flow Charts and algorithms.
2. To understand the basic concepts of control structures in C.
3. To learn concepts of arrays, functions, pointers and Dynamic memory allocation in C.
4. To use the concepts of structures, unions, files and command line arguments in C.

Course Outcomes:

After successful completion of the course, the students are able to

1. Develop algorithm and flowchart for simple problems.
2. Use suitable control structures and arrays for developing code in C.
3. Design modular structured programs using functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

List of Exercises / Activities:

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings:
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls:
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation:
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations
Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EE/CE/ME 163 :: ENGINEERING GRAPHICS & DESIGN Lab

Semester I / II [First Year]

L	T	P	C	Int	Ext
1	0	4	3	40	60

Course Objectives

The course will enable the students to

1. Expose the students to standards and conventions followed in preparation of engineering drawings.
2. Make them understand the concepts of orthographic and isometric projections
3. Develop the ability of conveying the engineering information through drawings.
4. Make them understand the relevance of engineering drawing to different engineering domains.
5. Develop the ability of producing engineering drawings using drawing instruments.
6. Enable them to use computer aided drafting packages for the generation of drawings.

Course Outcomes

After completion of this course, students will be able to

1. Prepare engineering drawings as per BIS conventions mentioned in the relevant codes.
2. Produce computer generated drawings using CAD software.
3. Use the knowledge of orthographic projections to represent engineering information / concepts and present the same in the form of drawings.
4. Develop isometric drawings of simple objects reading the orthographic projections of those objects.
5. Convert pictorial and isometric views of simple objects to orthographic views.

(Units I to IV shall be taught in conventional drawing method and Unit V shall be taught with the aid of computer)

UNIT-I

General: Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering.

Conic sections: Construction of Ellipse, Parabola, Hyperbola and Rectangular Hyperbola. (General method only)

Curves: Cycloid, Epicycloid, Hypocycloid and Involute; and **Scales**

UNIT-II

Method of Projections: Principles of projection - First angle and third angle projection of points, Projection of straight lines inclined to both planes. Traces of lines.

Projections of planes: Projections of planes inclined to both the planes, projections on auxiliary planes.

UNIT-III

Projections of Regular Solids: Projections of solids (Prism, Pyramid, Cylinder and Cone) with varying positions.

Sections of Solids: Sections of Prisms, Pyramids, cylinders and Cones. True shapes of sections. (Limited to the cutting plane perpendicular to one of the principal plane).

Development of surfaces: Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT-IV

Isometric Projections: Principles of Isometric projection-Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids

Orthographic Projections: Conversion of pictorial views into Orthographic views and Vice-versa. (Treatment is limited to simple castings).

Perspective Projections: Introduction to Perspective Projection

UNIT-V

Over view of Computer Aided drafting (AutoCAD) : Introduction, starting and customizing AutoCAD screen, usage of different menus, toolbars(drawing, editing, dimension, text, object properties..etc), tabs (Object, snap, grid, polar, ortho, otrack..etc) and command prompt. Setting units, limits, layers and viewports (Isometric, Top, Front, back..etc). 2D drawings of various mechanical and structural components, electrical and electronic circuits. Orthographic and Isometric views of mechanical castings and simple structures.

Suggested Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

EE 164 :: ELECTRICAL CIRCUITS LAB
Semester II [First Year]

L	T	P	C	Int	Ext
0	0	2	1	40	60

Course Objectives:

The main objectives of this lab course are

1. To conduct experiments on electrical circuits.
2. To design experimental setups for theorems.
3. To know the response of electrical circuits for different excitations

Course Outcomes:

Upon completion of this laboratory, the student will be able to:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Use common electrical measuring instruments.
4. Conduct experiments on RLC circuits to study resonance phenomenon.
5. Verify the network theorems.

List of experiments/demonstrations:

1. Familiarisation of Electrical Installations and Electrical Testing Equipment: Miniature circuit breakers (MCBs), Moulded Case Circuit Breakers (MCCBs), Earth-leakage circuit breakers (**ELCBs**), Fuses, Types of Wires, Wire Gauges, continuity test, megger, Cables and Earthing.
2. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, wattmeter, multi-meter, oscilloscope, measurement ofbasic parameters.
3. Verification of KVL& KCL.
4. Verification of Thevenin's Theorem.
5. Verification of Superposition Theorem.
6. Verification of Maximum power transfer theorem
7. Verification of reciprocity theorem.
8. Verification of Norton's Theorem.
9. Measurement of active power in single phase circuit by using single wattmeter.
10. Series resonance characteristics.
11. Parallel resonance characteristics.
12. Parameters of choke coil.
13. To study R-L series circuits (AC)
14. To study R-C series circuits (AC)
15. To study R-L-C series circuits (AC)
16. To study R-L-C parallel circuits (AC).

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EE 211 :: Electrical Circuit Analysis

Semester III [Second Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To introduce AC three phase power measurement techniques
2. To calculate response of network functions by pole zero diagrams and Fourier transforms
3. To analyse two port network parameters and coupled circuits
4. To design filter circuits and synthesize networks

Course Outcomes:

After completion of the course, the students are able to:

1. Calculate and measure power in 3-phase circuits
2. Use Fourier transforms for electrical circuit analysis
3. Illustrate two port networks and applications of coupled circuits
4. Design filter circuits and synthesize electrical networks

Course Content:

UNIT – I [Text book -1] **[15]**

Poly phase systems: Advantages of 3-phase systems – generation of 3-phase voltages - phase sequence - star & delta connections - interconnection of 3-phase sources and loads - voltage, current & power in star & delta connected systems - analysis of 3-phase balanced circuit - measurement of 3-phase power- 2 wattmeter method. Analysis of 3-phase unbalanced systems – star / delta transformation method - application of KVL and Millman's method.

UNIT-II [Text book -1] **[15]**

Network Functions: Network functions for the one port and two port networks - Poles and Zeros of network functions - Restrictions on pole and zero locations for driving point functions and transfer functions - Time domain behavior from the pole zero plot.

Fourier Series & Fourier Analysis: Trigonometric and exponential Fourier series, representation of periodic function by Fourier series, Fourier transforms of simple functions, Applications to circuit analysis.

UNIT –III [Text book -2] **[15]**

Two port networks: Open circuit impedance and short circuit admittance parameters, transmission (ABCD) and inverse transmission parameters, hybrid and inverse hybrid parameters, interrelation between them, image parameters, inter connection of 2-port networks.

Coupled circuits: Defining self and mutual inductance, coefficient of coupling, dot convention, development of circuit equations in time domain and frequency domain, solution of coupled circuits, series and parallel connections of two coupled coils, tuned circuit analysis (single and double tuned)

UNIT – IV [Text book -2] **[15]**

Filters: Low pass, high pass & band pass filters - frequency response, constant K – and M filters.

Network Synthesis: Hurwitz polynomial – properties of positive real functions – Synthesis of RC, RL & LC driving point impedances and RL, RC admittances – CAUER and FOSTER methods of Synthesis.

LEARNING RESOURCES:

TEXT BOOKS:

1) W.H.Hayt&J.E.Kimmerly - Engineering circuit analysis, 8th Edition,TMH, 2013
2) A.Sudhakar and Shyammohan - Circuits and Networks: Analysis and synthesis, 5th Edition, TMH, 2015

REFERENCE BOOKS:

1) M Nahvi , Joseph Edminister , K Rao - Electric Circuits, (Schaum's Outline Series) , 5th edition, TMH, 2017
2) F.F. Kuo - Network analysis and synthesis, 2nd edition, Wiley student edition, 2006
3) Cunningham & J.A. Stuller - Basic circuit analysis, 1st edition, Jaico publishing, 1996
4) M.E. Vanvalkenberg - Network analysis, 3rd Edition, Pearson Education, 2019
5) M.S.Sukhija and T.K.Nagsarkar - Circuits and Networks: Analysis, design and synthesis, 2nd edition, Oxford press, 2016

Web References:

1. project.mvps.org/networkanalysis.htm % Applications of NA
2. books.google.com/books/about/Network_Analysis.html?id=17IP... % References
3. www.allaboutcircuits.com › ... › DC NETWORK ANALYSIS % DC network analysis
4. www.microimages.com/documentation/Tutorials/network.pdf % Network analysis tutorials
5. www.robcross.org/network_tutorials.htm % Network analysis tutorials

EE 212 :: Electronic Devices & Circuits

Semester III [Second Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

COURSE OBJECTIVES:

1. To understand the basics of semiconductor devices.
2. To understand the principle of operation, characteristics and applications of Diode, Tunnel Diode.
3. To understand the principle of operation and characteristics of Bipolar Junction Transistor, photo transistor, biasing and thermal stabilization of transistor.
4. To understand the BJT as an amplifier, principle of operation and characteristics of JFET and MOSFET.
5. To analyze the frequency response of transistor amplifier circuits

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Describe the basics of semiconductor devices.
2. Illustrate the principle of operation, characteristics and applications of Diode, Tunnel diode.
3. Discuss about principle of operation and characteristics of Bipolar Junction Transistor, photo transistor, biasing and thermal stabilization of transistor.
4. Design various Equipment which are used in the construction and operation of electronic devices.
5. Examine the frequency response of transistor amplifier circuits

COURSE CONTENT:

UNIT I Text Book-1 [15]

PN JUNCTION: Basic Structure of the PN Junction, Zero applied Bias, Forward and Reverse applied Bias, PN Junction Current, Generation-Recombination Currents, Junction Break Down, Zener diode as voltage regulator, Capacitances of The Diode. Tunnel Diode.

Applications: NON-LINEAR WAVE SHAPING: Clipping circuits with diodes, clipping at two independent levels, transfer characteristics of clippers, multi-diode circuits, clamping circuits.

RECTIFIERS: Half wave Rectifier and Full wave Rectifier with and without Capacitor filter only.

UNIT II Text Book-1 [15]

BIPOLAR TRANSISTOR: The Bipolar Transistor Action, Equivalent Circuit Models: Hybrid-Pi Model,

TRANSISTOR CHARACTERISTICS: Common Emitter, Common Base and Common Collector Characteristics, Photo Transistor.

TRANSISTOR BIASING: The Operating Point, Bias Stability, Biasing Techniques, Stabilization against variations in I_{CO} , V_{BE} , β , Thermal Runaway.

UNIT – III Text Book-1 [15]

BJT AMPLIFIERS: Basic BJT Amplifiers, Analog Signals and Linear Amplifiers, The Bipolar Linear Amplifiers, Common-Emitter Amplifiers, Common-Collector Amplifier, Common-Base Amplifier, Multistage Amplifiers. [Theory only]

JUNCTION FIELD-EFFECT TRANSISTOR: JFET Concepts, Device Characteristics

METAL-OXIDE-SEMICONDUCTOR FIELD-EFFECT TRANSISTOR: MOSFET Construction, Operation, Types, E-Mosfet, D-Mosfet, Characteristics

UNIT IV Text Book-1 [12]

FET AMPLIFIERS: MOSFET DC Circuit Analysis, The MOSFET Amplifier, The Common Source Amplifier, The Common Drain Amplifier, The Common Gate Configuration, Multistage Amplifiers. [Theory only]

FREQUENCY RESPONSE: Amplifier Frequency Response, System Transfer Functions, Transistor Amplifiers with Circuit Capacitors, Bipolar Transistor Frequency Response, The FET Frequency Response, High Frequency Response of Transistor Circuits. [Theory only]

Learning Resources:

Text Book(S):

1. Donald A. Neamen -, Micro electronics circuit analysis and design, 4th edition, TMH, 2010
2. Jacob Millman and Christos C. Halkias - Integrated Electronics, 2nd edition, TMH, 2017

Reference Book(S):

1. Donald A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, TMH, 2007.
2.Ben G Streetman and Sanjay Banerjee, Solid State Electronic Devices, 5th Edition,2000
3. Varsha Agrawal Anil K. Maini - Electronic Devices and Circuits, Wiley (2009)

Web Resources:

1. http://nptel.iitm.ac.in/courses/
2. http://www.deas.harvard.edu/courses/es154/

EE 213 :: DC Machines

Semester III [Second Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide students with strong foundation on the classification, construction, performance, testing and applications of D.C generators and Motors.
2. To enable the students to have a fair knowledge about construction, working principle, operation and applications of D.C generators and Motors.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Illustrate the details of magnetic circuits and their applications, properties of magnetic materials and electro mechanical energy conversion
2. Describe the working principle, construction, types of D.C generators, armature reaction and commutation.
3. Develop the characteristics of D.C generators and illustrate their applications. Illustrate the principle of D.C motors and torque equations.
4. Examine the characteristics of D.C motors and their applications, Illustrate the methods of speed control of D.C motors and necessity of starters.
5. Develop procedures for testing of D.C motors and calculate efficiency.

COURSE CONTENT:

UNIT - I [Text book -2] 15

Magnetic Circuits: Introduction – simple magnetic circuit - magnetic circuits with air gap - Air-gap fringing fields- Magnetic equivalent circuit - properties of magnetic materials -Hysteresis and eddy current losses - permanent magnetic materials. **Electro Mechanical Energy Conversions:** Energy in Magnetic system -field energy and mechanical force - mechanical energy. Torques in systems with permanent magnets.

UNIT – II [Text book -1, Text book -2,Reference book-1] 15

D.C. Machines: Constructional features - Types of Windings - Lap and Wave, Principle operation of DC Generators. Emf Equation, types of DC generators, Commutation, Armature reaction, interpolar and compensating windings. Losses and efficiency of generator, No load and load characteristics of all types of DC generators and their applications, Parallel operation of D.C. Generators.

UNIT-III [Text book -1, Text book -2,Reference book-1] 15

D.C. MOTORS: Principle of DC Motor, concept of back emf, torque equation, power stages of DC Motor, Characteristics of DC motors (series, shunt and compound), Applications. Speed control of DC shunt motor – Armature voltage control, Field flux Control. Ward-Leonard control (Voltage control), Various methods of Speed Control of DC Series Motor.

UNIT - IV [Text book -1, Text book -2,Reference book-1] 15

Starters of D.C motors: Necessity of a starter in a D.C motor, various starting techniques for DC motors: Three-point starter, four-point starter. Losses, efficiency of D.C motor and testing of DC Machines - Brake test, Swinburne's Test, Hopkinson's Test, Retardation Test, Field Test . Principle of operation of Amplidyne and Metadyne.

Learning Resources:

Text Books:

1. P.S. Bhimbra - Electric Machinery, 7th edition, Khanna Publications, 1973
2. I.J. Nagrath& D.P. Kothari "Electric Machines", 4th edition, Tata McGraw - Hill Publishers, 2019

Reference Books:

1. J. B. Gupta - Theory & performance of Electric Machines, S.K. Kataria&Sons, 2013
2. Irving L. Kosow - Electric Machinery & Transformers, Pearson, 2nd edition, 2007
3. Clayton &Hancock - Performance and Design of D.C Machines, CBS publishers, 2004
4. S. Kamakshaiah - Electro mechanics - I (D.C. Machines), Right Publishers, 1st edition, 2005
5. A.E. Fritzgerald, C. Kingsley & S. Umans –Electric Machinary, McGraw-Hill Companies, 6th editon 2017.
6. Samarjit Ghosh - Electrical Machines, Pearson 2nd edition, 2012

Web References:

1. www.nptel.iitm.ac.in/courses/IIT-MADRAS/Electrical_Machines.../2_1.pdf
2. www.gtbit.org/downloads/emecsem3/emecsem3n4qbank.pdf
3. www.freevideolectures.com
4. www.swe.siemens.com/spain/web/.../Catalogo%20motores%20cc.pdf
5. www.einsteincollege.ac.in/Assets/.../electrical%20engg%20notes.pdf

EE 214 :: Electromagnetic Fields

Semester III [Second Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To develop an understanding of electromagnetic field fundamentals by emphasizing both mathematical analytical rigor and physical conceptual reasoning.
2. Provide an ability to analyze engineering systems based on electrostatic fields, steady electric currents.
3. Provide an ability to analyze capacitance of common conductor configurations.
4. Develop an ability to analyze magneto static fields.
5. To develop a solid grasp about Maxwell's equations and their usage in solving time varying field problems.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Identify the details of formation of fields.
2. Solve realistic electromagnetic field problems utilizing physical conceptual reasoning and mathematical synthesis of solutions
3. Understand electric and magnetic properties of material media and how these properties can be exploited in engineering applications.
4. Utilize three dimensional vector differential and integral concepts to solve real life electromagnetic field problems.
5. Investigate the details of electromagnetic wave propagation.

COURSE CONTENT:

UNIT – I (TEXT BOOK 1 &2) 13

Electrostatics –I:

Coordinate systems: Cartesian, cylindrical, spherical co-ordinates, Experimental law of coulomb, Electric field intensity, Field due to a continuous volume charge distribution, Field due to a line charge, sheet of charge.

Electric flux density, Gauss's law, Applications of Gauss law, Maxwell's First equation (Electrostatics), Energy expended in moving a point charge in an electric field.

UNIT – II (TEXT BOOK 1 &2) 13

Electrostatics – II:

Definition of potential and potential difference. The potential field of a point charge, system of charges, potential gradient, the dipole and Energy density in electrostatic field.

Current and current density, continuity of current, conductor properties and boundary conditions. The nature of dielectric materials, boundary conditions for perfect dielectric materials.

Capacitance, Several capacitance examples, Derivations of Poisson's and Laplace's equations, Examples of the solution of Laplace's equation.

UNIT – III (TEXT BOOK 1 &2) 13

Magneto statics:

Biot-Savart's Law, Ampere's Circuital Law, Magnetic Flux and Magnetic Flux Density, scalar and vector magnetic potentials.

Magnetic Forces: Force on a moving charge- Lorentz force equation, Force on a differential current element, Force between differential current elements, Force and torque on a closed circuit.

Inductors and inductances: Inductor, Self Inductance, mutual inductance, energy stored and energy density in a magnetic field, Magnetic boundary conditions.

UNIT –IV (TEXT BOOK 1 &2) 13

Time Varying Fields and Maxwell's Equations: Faraday's law, Displacement current, Maxwell's equations in point form, integral form.

The Uniform Plane Wave: Wave propagation in free space, dielectrics and good conductors: skin effect, Poynting theorem and wave power.

TEXT BOOKS:

1. W H Hayt, J A Buck 'Engineering Electromagnetics', 8th Edition TMH, 2012.
2. Mathew NO Sadiku, 'Elements of Electromagnetics', 6th Edition Oxford University Press, 2014.

REFERENCE BOOKS:

1. Joseph A Edminister, 'Theory and Problems of Electromagnetics', 4th Edition, Schaum's Outline Series, Mc-Graw Hill International, 2014
2. EC Jordan and KG Balmain, 'Electromagnetic Waves and Radiating Systems', 2nd Edition PHI 2003.

E-RESOURCES:

http://nptel.ac.in/courses/108106073/
http://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring-2008/
http://freevideolectures.com/Course/2340/Electromagnetic-Fields#

EE 215 :: Basic Civil & Mechanical Engineering

Semester III [Second Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course objectives:
To enable the circuit branch students to acquire fundamental knowledge in Civil and Mechanical Engineering disciplines for application oriented concepts.

Course Outcomes:
Upon successful completion of the course the student will be able to
1. Acquire knowledge of surveying and materials used in construction industry
2. Understand the concepts of foundation and structures , Understanding the concepts of mechanics
3. Be acquainted with power plants and the equipment used in power plants
4. Understand the working principles of IC engines, refrigeration systems and transmission of mechanical energy.

Course Contents:

A – CIVIL ENGINEERING

UNIT – I

12 hours

Surveying and Civil Engineering Materials

a) **Surveying:** Objectives; Classification; Fundamental Principles; Measurements of distance- chaining a line on flat surface, Measurement of Angles by Theodolite, Levelling-Basic Definitions and Methods, Height of Instrument method, Area measurement-Triangular method-illustrated problems.

b) **Building Materials:** Stones- Types, Properties; Bricks- Types, Properties, Classification of Bricks based on Quality; Cement-Types, Physical Properties of OPC; Sand; Cement Mortar- Properties and uses.

UNIT – II

12 hours

Building components and structures

a) **Structures**: Elements of a Building and Basic Requirements of a Building, Brick masonry and Stone masonry; Foundations- Types of Foundations

b) **Mechanics**: Internal and external Forces-Stress, Strain, Elasticity, Shear force, Bending Moment and Torsion; simple problems on SFD and BMD for cantilever and simply supported beams due to point load and UDLs

B – MECHANICAL ENGINEERING

UNIT III

15 hours

BOILERS, TURBINES and PUMPS

(a) Boilers – Classification, Working of Babcock-Wilcox water tube boiler and Cochran Fire tube boiler, Differences between Fire tube and Water tube boiler.

Pumps – construction and working of Reciprocating and Centrifugal pumps.

(b) Turbines

Water Turbines – Classification, construction and working of Pelton wheel turbine, Francis turbine and Kaplan turbine

UNIT IV

15 hours

(a)THERMAL SYSTEMS:

I.C Engines - Classification of IC Engines – Components in I.C engine, working principle of SI & CI engines – comparison of 2 stroke & 4 stroke engine and SI & CI engines - Applications.

Refrigeration and Air Conditioning – Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – summer and winter air conditioning systems.

(b)TRANSMISSION OF POWER: Transmission of Power – Belt Drives – Types of Belts – Materials – Velocity Ratio – Ratio of Tensions – Flat Belt – V-Belt — Rope Drives — Gear Drives – Types – Speed Ratio – Materials – Simple problems in Transmission of Power by Belt drives.

Text Books:

1. Surveying by Dr. K. R. Arora, Rajsons Publications Pvt. Ltd
2. Basic Civil Engineering by S. S. Bhavikatti; New Age International (P) Lmited, Publishers
3. Mathur, Mehta&Tewari, Elements of Mechanical Engineering, DhanpatRai& Sons, 13/E.

Reference Books:

1. Mechanics of materials; by Dr. B. C. Punmia, Er. A. K. Jain and Dr. Arun kumar Jain
2. Engineering mechanics by S S Bhavikatti & K. G. Rajasekharappa; New Age International
3. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
4. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

EE 216 :: Digital Electronics

Semester III [Second Year]

L	T	P	C	Int	Ext
3	0	-	3	40	60

COURSE OBJECTIVES:

Students will be able to know

1. To understand different types of number systems used in digital systems. Boolean functions simplification using Karnaugh maps and Quine-McCluskey methods.
2. Combinational circuits design procedure and implementing them.
3. The operation and design methodology for sequential circuits.
4. To understand about different types of IC logic families & the programmable logic devices like ROM, PLA & PAL.

COURSE OUTCOMES:

After successful completion of the course, the students are able to:

1. Illustrate basic digital logic fundamentals such as numbering systems, Boolean functions minimization methods.
2. Describe the operation and design procedure of combinational circuits.
3. Comprehend the operation and design methodology for sequential circuits.
4. Explain different types of IC logic families & memory elements.

COURSE CONTENT:

UNIT I Textbook – 1 (15)

NUMBER SYSTEMS AND CODES: Decimal, Binary, Octal, Hexadecimal Number systems and their conversions, r's and (r-1)'s Complements, Codes: BCD, Excess 3, Gray, Alphanumeric codes.

BOOLEAN ALGEBRA: Boolean expressions and theorems, Logic gates, Universal gates, Canonical and standard forms, Boolean functions, simplification of Boolean functions using K maps (up to five variables), Minimal functions and their properties, Tabulation method, NAND implementations two level and Multilevel.

UNIT II Textbook – 1 & 3 (12)

COMBINATIONAL LOGIC CIRCUITS: EX-OR, EX-NOR Circuits, General design procedure for Combinational logic circuits, Design and applications of Binary Adders and Subtractors, Comparators, Encoders, Decoders, Multiplexers and Demultiplexers, Design of BCD to 7 Segment Decoder, Parity Generator and Checker, BCD Adder / Subtractor, Carry look ahead adders

UNIT III Textbook – 1 & 3 (17)

Sequential Elements: Latches, Timing Considerations, Characteristic Table, Characteristic Equation, Excitation table, State table and State diagrams for SR, JK, Master Slave JK, D and T Flip-flops, Conversion from one type of Flip-flop to another.

Sequential Circuits: Shift Registers, Counters, Design of Ripple counters, Synchronous counters. Analysis and Synthesis of Sequential Circuits-Sequence Generator, Sequence Detector.

UNIT IV Textbook – 1 (10)

IC Logic Families: RTL, DTL, TTL, ECL, MOS, CMOS and IIL families and their comparison.
Programmable Logic Devices: ROM, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL).

Learning Resources:

Text Book(S):

1. M Morris Mano, Digital Logic and Computer Design, PHI/Pearson Education, 2003.
2. RP Jain, Modern Digital Electronics, 3rd Edition, TMH, 2003
3. Fundamentals of Digital Circuits, A.Anand Kumar, 4th Edition, Pearson Education.

Reference Book(S):

1. Thomas L. Floyd - Digital Fundamentals, 10th Edition, Person Education, 2011
2. Brown-Vranesic - Fundamentals of Digital Logic with Verilog Design, 3rd edition, TMH, 2013.
3. Donald D. Givone - Digital Principles and Design, TMH, 2003.

Web Resources:

1. https://nptel.ac.in/courses/117103064/
2. https://nptel.ac.in/courses/117105080/3

EE 251 :: Electronic Devices & Digital Electronics Lab

Semester III [Second Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

1. To plot the characteristics of basic electronic devices like p-n junction diode, zener diode, BJT characteristics in various configurations, JFET, UJT.
2. To design and verify the self bias circuit.
3. To design Combinational logic circuits such as adders, subtractors, decoders, code converters, multiplexers.
4. To design Sequential logic circuits such as flip-flops, shift registers, synchronous and asynchronous counters.

Course Outcomes:

Upon successful completion of the practical, the student will be able to:

1. Obtain the characteristics of devices like p-n Junction diode, zener diode, BJT in CE, CB configurations, JFET, UJT, Design the self bias circuit.
2. Design the Zener voltage regulator to meet the specifications.
3. Design Combinational logic circuits such as adders, subtractors, Code converters, decoders, multiplexers.
4. Design Sequential logic circuits such as flip-flops, shift registers, synchronous and asynchronous counters.

List of Experiments:

- Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs);
- Identification, Specifications, Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs;
- Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO; CRO

1. Study the characteristics of PN Junction and Zener diode.
2. Study the characteristics of Transistor in Common Emitter configuration.
3. Study the characteristics of Transistor in Common Base configuration.
4. Verification of Transistor Self Bias Circuit.
5. Study the Characteristics of Junction Field Effect Transistor.
6. Study the Characteristics of Uni junction Transistor.
7. Study of Half wave rectifier with and without filters.
8. Study of Full wave rectifier with and without filters.
9. Realization of Gates using Discrete Components.
10. Realization of Gates using Universal Building Block (NAND only).
11. Design of Combinational Logic Circuits like Half-adder, Half-subtractor, Full-adder and Full-subtractor.
12. Design of Code converters (Binary to Gray).
13. Design of Multiplexers & Decoders.
14. Verification of Truth Tables of Flip Flops using Gates.
15. Design of Shift Register, Ring Counter and Johnson Counter using Flip Flops.
16. Design of Asynchronous counter- Mod counter, Up counter, Down counter and Up/Down counter using Flip Flops.

17. Design of Synchronous Counter- Mod Counter, Up counter, Down counter and Up/Down counter using Flip Flops.
18. Design of Sequence Generators using shift Registers and Multiplexers.

NOTE: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations.

EE 252 :: DC Machines Lab
Semester III [Second Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

The main objectives of this lab course are

1. To conduct experiments on theory taught in electrical circuits, electrical machines.
2. To design experimental setups for theorems.
3. To conduct experiments on DC machines (Generator, motor)
4. To introduce PSPICE as simulation tool for circuits.
5. To conduct nodal analysis, superposition theorem using PSPICE, Field's test on DC series MG set.

Course Outcomes:

The student will be able to

1. Design circuits for DC and AC analysis with theorems.
2. Predetermine performance of DC machine.
3. Determine performance of DC machines by direct tests.
4. Develop programs for circuit analysis using PSPICE.

LIST OF EXPERIMENTS IN THE LAB:

1. Determination of Z, Y parameters of a given two port network
2. Open circuit characteristics of separately excited / self excited D.C shunt generator
3. Load test on D.C Shunt Generator
4. Load test on D.C Compound Generator
5. Load test on D.C series generator
6. Swinburne's Test
7. Speed control of DC shunt motor
8. Brake test on D.C Shunt Motor
9. Hopkinson's test on D.C Machines
10. Retardation test on D.C. Machine
11. Simulation of RLC circuits

i) Steady state analysis ii) Transient analysis

12. Simulation of Thevenin's and Norton's theorems
13. Simulation of Maximum power transfer theorem and superposition theorem
14. Simulation of Load test on D.C Shunt Generator
15. Simulation of Speed control of DC shunt motor

Note: Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations.

Learning Resources:

Text Books:

1. P.S. Bhimbra, 'Electric Machinery' Khanna Publications, 7thedition.
2. I.J. Nagrath& D.P. Kothari 'Electric Machines ', Tata McGraw - Hill Publishers.

Web references:

1. www.gtbit.org/downloads/emecsem3/emecsem3lmannual.pdf
2. www.centennialcollege.ca/Programs/Documents/.../ECME-123.pdf
3. www.iitk.ac.in/ee/labs/CSL/support_files/EE380_labmanual.pdf
4. www.bcit.ca/study/courses/elex7240

EE 253 :: Basic Civil & Mechanical Engineering Lab
Semester III [Second Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objective:

To provide exposure to the students with hands on experience on basic engineering practices in Civil, Mechanical Engineering.

Course Outcomes:

Upon successful completion of the course the student will be able to:

1. Prepare basic surveying reports
2. Use the civil engineering instruments appropriately
3. Study the operation of Pumps and IC engines
4. Conduct performance tests on IC engines
5. Able to find viscosity, flash & fire points of oils and fuels.

List of Experiments:

A- CIVIL ENGINEERING

1. Chain Surveying
2. Measurement of Distance.
3. Measurement of Angles.
4. Measurement of Levelling
5. Measurement of Areas.
6. Measurement of Stress & Strain using UTM.
7. Measurement of Strength of Bricks & Concrete.
8. Performance Study on Single Stage Centrifugal Pump.

B- MECHANICAL ENGINEERING

1. VTD on four stroke diesel engine and PTD on two stroke petrol engine
2. Load test on single cylinder, 4-stroke diesel engine with electric dynamometer
3. Determination of Flash and Fire points using Cleveland's apparatus
4. Determination of viscosity of given oil using Redwood viscometer I
5. Study of refrigeration and air conditioning tutors
6. Study of boilers and mountings

NOTE: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations.

EE 221 :: Mathematics – III (Probability & Statistics)

Semester IV [Second Year]

L	T	P	C	Int	Ext
3	1	-	4	40	60

Course Objectives:

The objectives of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Course Outcomes: Upon completion of the course, the students will learn:

1. The ideas of random variables and various discrete and continuous random variables and their properties.
2. The application of various probability distribution concepts to solve the engineering problems.
3. The basic ideas of statistics including correlation, regression, least squares fit to various curves.
4. The statistical methods for analyzing experimental data by testing the hypotheses.

Course Content:

Unit-I : Basic Probability: (10 lectures)

Discrete random variables and their properties, Expectation of Discrete Random Variables, Continuous random variables and their properties, Expectation of Continuous Random Variables, Distribution functions and densities, Moments, Chebyshev's Inequality.

Unit-II : Discrete and Continuous Probability Distributions: (16 lectures)

Binomial distribution, infinite sequences of Bernoulli trials, Poisson approximation to the Binomial distribution- Evaluation of statistical parameters for these distributions.

Normal, Exponential and Gamma densities-. Evaluation of statistical parameters for these distributions.

Unit-III : Applied Statistics: (14 lectures)

Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

Unit-IV: Small and Large sample tests: (14 lectures)

Test for single mean, difference of means, test for ratio of variances, Chi-square test for goodness of fit for Binomial and Poisson Distributions, and independence of attributes.

Tests of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Learning Resources:

Text Book:

1) Miller & Freund's Probability and Statistics for Engineers – Richard A. Johnson

Reference Books:

1) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003
3) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
5) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2010.
6) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7) Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
8) S.C.Gupta and V.K.Kapoor., Fundamentals of Mathematical Statistics, Sultan Chand & Co

EE 222 :: Life sciences for Engineers
Semester IV [Second Year]

L	T	P	C	Int	Ext
2	-	-	2	40	60

Course Objectives

i. Recall the basics of biology viz. cellular organization, function and classification.
ii. Provide an understanding of the basic structure and functions of major biomolecules.
iii. Describe the transfer of genetic information and Introduce the techniques used for modification of living organisms
iv. Describe the applications of rDNA technology and biomaterials

Course Outcomes

1) Understand and appreciate the cellular organization and its diversity
2) Recognize and understand the molecular basis of different forms of life and their applications
3) Identify the complementarity in the structure and functions of biomolecules
4) Differentiate the genetic phenomena and demonstrate the genetic engineering of organisms

Unit I : Living Organisms (CO 1) 6 hours

Comparison of biological organisms with manmade systems, Classification of living organisms, Cellular basis of life.
Differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources, molecular taxonomy.

Unit II: Proteins and Enzymes (CO 2) 6 hours

Water, Biomolecules – carbohydrates, proteins and lipids, structure and functions of proteins and nucleic acids, hemoglobin, antibodies.

Enzymes: Basic Structure and Classification of Enzymes; Enzymes in Fermentation and industrial applications

Unit III : Cell Physiology (CO 3) 6 hours

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation.
Mechanism of photosynthesis; Neurons, synaptic and neuromuscular junctions

Unit IV: Genes and genetic material (DNA and RNA) (CO 4) 10 hours

Mendel's laws, gene mapping, Mitosis and Meiosis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation
Recombinant DNA Technology: recombinant vaccines, transgenic microbes, animal cloning, biosensors, biochips.

Learning Resources

Text books

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011

Reference Books

1. Alberts et al. The molecular biology of the cell, 6th edition, Garland Science, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3rd edition, 2012.

EE 223 :: Electronic Circuit Analysis

Semester IV [Second Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

COURSE OBJECTIVES:

1. To know the responses of RC low-pass and high-pass circuits for standard inputs
2. To know the working of multivibrators using BJTs
3. To introduce feedback concepts and discuss advantages of using feedback in electronic circuits
4. To analyse the four ideal feedback circuit configurations
5. To describe the concept of power amplifier and characteristics of power transistors
6. To determine maximum power efficiency of several circuit configurations of class-A and class-AB power amplifiers.
7. To analyse and design oscillators that provides sinusoidal signals at specified frequencies.
8. To derive expressions for errors that define the goodness of the sweep circuit and to study the various sweep generators

COURSE OUTCOMES:

After successful completion of the course, the students will be able to

1. a) Derive the expressions and plot the responses of RC high-pass and low-pass circuits to different types of inputs. Describe the application of high-pass circuit as a differentiator and low-pass circuit as an integrator.
   b) Describe the working of different types of multivibrators and derive expressions for the frequency of oscillations.
2. Examine four ideal feedback circuit configurations and determine circuit characteristics including input and output resistances.
3. Determine the maximum power efficiency of several circuit configurations of class-A and class-AB power amplifiers.
4. a) Analyze oscillators that provide sinusoidal signals at specified frequencies.
   b) Describe UJT, transistor sweep generators and circuits that can improve the linearity of the voltage sweep.

UNIT-I **Text Book - 1 (16)**

LINEAR WAVE SHAPING: Responses of RC high-pass circuit and low-pass circuit to sinusoidal, step, pulse, square, exponential and ramp inputs, Criteria for good differentiation and integration

MULTIVIBRATORS (using BJTs): Bistable Multivibrator: fixed bias bistable multivibrator, commutating capacitors, resolution time and maximum switching speed, unsymmetric and symmetric triggering, Schmitt triggers, methods to eliminate hysteresis, operation of collector coupled monostable and astable multivibrator.

UNIT-II **Text Book - 2 (10)**

FEEDBACK AMPLIFIERS: Introduction to feedback, basic feedback concepts, Ideal feedback topologies: Series-Shunt configuration, Shunt-Series configuration, Series-Series configuration, Shunt-Shunt configuration.

UNIT-III **Text Book - 2 (10)**

POWER AMPLIFIERS: Power Transistors, Classes of Amplifiers, Class-A Power Amplifiers, Class-AB Push-Pull Complementary Output Stages (diode biasing, using V_{BE} multiplier)

UNIT-IV **Text Book - 2 (8)**

OSCILLATORS: Basic principles for oscillation, Phase Shift Oscillator, Wien-Bridge oscillator, Hartley

Oscillator, Colpitts Oscillator, Crystal Oscillator.

VOLTAGE SWEEP GENERATORS: Introduction, exponential sweep generators: using UJT, using CB configuration, improving sweep linearity: Miller integrator sweep generator and Bootstrap sweep generator.

Text Book - 1 (8)

Learning Resources:

Text Book(S):

1. Pulse and Digital Circuits by Venkata Rao.K, Rama Sudha.K, Manmadha Rao.G Pearson first edition.
2. Electronic Circuits: Analysis and Design by Donald A Neamen Third Edition TMH.

Reference Book(S):

1. Mothiki S. Prakash Rao, Pulse Digital & Switching Waveforms, 2nd Edition, TMH.
2. Taub and Schilling, Digital Integrated Electronics, Mc-Graw Hill, 1977.

Web Resources:

1. http://nptel.ac.in/courses/117106086/
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-374-analysisand-design-of-digital-integrated-circuits-fall-2003/

EE 224 :: AC Machines

Semester IV [Second Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide students with strong foundation on the classification, construction, performance, testing and applications of Transformers and Induction Motors.
2. To enable the students to have a fair knowledge about construction, working principle, operation and applications of Transformers and Induction Motors.

Course Outcomes

Upon successful completion of the course, the student will be able to:

1. Illustrate the principle of operation of a transformer and its applications. Examine different types of losses and testing procedures of transformers and solve the problems related to transformers.
2. Discuss the details of connections like star-delta, 3-ph to 2-ph and get the knowledge of parallel operation and load sharing.
3. Describe the principle of operation and testing of poly phase induction motor, and draw Equivalent circuit.
4. Draw the circle diagram and illustrate the details of starters, speed control. Explain the principle of induction generator and its applications.
5. Outline the working principle of 1-ph induction motors, characteristics and their applications.

COURSE CONTENT:

UNIT – I **[Text Book- 1] 15**

Transformers: Constructional features of transformers - EMF equation – no load and load phasor diagram - equivalent circuit of single phase transformers. Regulation - losses - efficiency and all day efficiency .Testing of transformers: OC & SC tests - Sumpner's test etc. Auto transformers.

UNIT - II **[Text Book- 2] 15**

3-phase transformer windings and its connections. Open delta - Scott connected transformers - 3 phase to 2 phase conversion. Parallel operation of Single Phase Transformers and its load sharing. Tap changing in transformers, methods of cooling.

UNIT - III **[Text Book- 1] 15**

Poly Phase Induction Motors: Rotating magnetic field in two phase & three phase systems - construction and operation of 3-phase induction motors. Torque equation and torque slip characteristics - equivalent circuit. Power losses – Efficiency, Testing of induction motors – No load and Blocked rotor Tests, Circle Diagrams.

UNIT –IV **[Text Book-1] 15**

Types of starters - Speed control of 3-Phase Induction motors- Voltages control, Supply Frequency Control(V/f), Rotor resistance control, Pole changing and Cascaded method. Crawling and Cogging -Double cage rotors - Induction generators and their applications,

Single Phase Induction Motors: Double field revolving theory – starting methods Split phase - capacitor start and run -shaded pole motors -characteristics and their applications. Equivalent Circuits of single phase induction motors.

LEARNING RESOURCES:

TEXT BOOKS:

1. P.S. Bhimbra „Electric Machinery", Khanna Publications 7th edition.
2. I.J. Nagrath&D.P.Kothari „Electric Machines" TataMcGraw Hill, 7thEdition.2005.

REFERENCE BOOKS:

1. Langsdorf „Theory of Alternating Current Machinery" Tata McGraw-HillCompanies,2nd edition.
2.P.C. Sen John „Principles of Electrical machines and power electronics" Wiley & Sons 2003.
3. Irving L. Kosow „Electrical Machinery & Transformers" PHI.
4. J.B. Gupta „Theory of performance of electrical machines", S.K.Khataria& Son's Publications.
5. M.G. Say „Performance & Design of AC Machines" BPB Publishers.
6.S.K.Battacharya „Electrical machines„ TataMcGraw Hill, 3rd edition.
7. B.L.Theraja,A.K.Theraja"A Text book of Electrical technology Volume-II" S.Chand

WEB RESOURCES:

1. www.electrical4u.com/electrical-transformer/three-phase-transformer.php
% reference for single phase & three transformers
2. ww.hammondpowersolutions.com/products/locate_by_product/Autotransformers /index.php% reference for autotransformers
3. www.electrotechnik.net/2006/08/in-autotransformer-primary-and.html % for autotransformers
4. www.allaboutcircuits.com/vol_2/chpt_13/7.html % poly phase induction

EE 225 :: Electrical Power generation
Semester IV [Second Year]

L	T	P	C	Int	Ext
2	1	-	3	40	60

COURSE OBJECTIVES:
1. To know various factors associated with power plants, power plant economics.
2. To know about factors affecting selection of type of power generating station & tariff structure.
3. To make the student to understand various types of electrical power generation in detail.
4. To understand the significance of non-conventional energy resources, power generation using solar, wind, tidal, geo thermal and fuel cells.

COURSE OUTCOMES:
Upon successful completion of the course, the student will be able to:
1. Describe the deals of factors associated with power plants, power plant economics.
2. Illustrate the factors affecting selection of type of power generating station & tariff structure.
3. Understand various types of electrical power generation in detail.
4. Examine the significance of non-conventional energy resources, power generation using solar, wind, tidal, geo thermal and fuel cells.

COURSE CONTENT:
UNIT - I **[Text Books 1&2] (15)**

Choice of power stations and units: Types of power stations – choice of generation - size of generator units - load duration curve - effect of variable load on plant operation and design.

Thermal power stations : Selection of site for thermal station – layout and salient features - boilers - economizers - condensers - coal handling - feed water treatment - steam turbines - turbo generators.

Hydroelectric Stations: Hydrology - hydrographs - mass curves - classification of hydroelectric plants - general arrangement and operation of hydroelectric plants and its function.

UNIT – II **[Text Books 1&2, Reference Book 2] (15)**

Nuclear Power Stations: Principles of nuclear power station – basic factors in designing of reactors - pressurized water reactor – boiling water reactor - CANDU reactor - liquid metal cooled reactor – shielding and safety precautions.

Gas Turbine Plants: Layout of gas turbine plant - principle of operation - open cycle and closed cycle plants. Improvement of thermal efficiency of gas plant.

Combined cycle Plants: Introduction - stag combined cycle plant - combined cycle with nuclear gas turbine and fossil fuel fired steam turbine

UNIT – III **[Reference Book2] (15)**

Solar Energy: Basics of solar energy - solar constant - extra terrestrial radiation - types of conversion systems - solar thermal power plants - solar pond - solar cell.

Wind Energy: Principles of wind power - types - wind turbine operation, types of wind generators, Tidal energy-Geo thermal Energy - Fuel cells.

UNIT - IV **[Text Books 1&2] (15)**

Economical Aspects: Economics of generation - factors affecting cost of generation - Definitions: load factor - diversity factor - plant use factor - reduction of cost by inter connected stations. Power factor considerations - causes of low power factor - methods of improving power factor - phase advancing and generation of reactive KVAR – most economical power factor for constant KW load and constant KVA type loads.

Tariff : Characteristics of Tariff - types of Tariff.

LEARNING RESOURCES:
TEXT BOOKS:
1. Elements of Electrical power station design by M.V. Deshpande, Wheeler Publishing Co.

2. Generation of Electric Power by B.R. Gupta S. Chand & Company Ltd.
3. Non-conventional energy sources by G. D. Rai Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. Renewable Energy Resources by John Twidell & Tony Weir, 3rd Edition, Taylor & Francis.
2. Power plant Technology by M.M.el.Wakil, TMH Publishing Company. Ltd., New Delhi.

WEB REFERENCES:

1. www.neptel.iitm.ac.in
2. http://solarsystem.nasa.gov/features/planet/sun
3. www.microhydropower.net

EE 261 :: AC Machines Lab
Semester IV [Second Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

The main objectives of this lab course are

1. To design experimental setup for calculating two port network parameters.
2. To design experiments to study the performance and operation of transformers.
3. To develop experimental setups for studying the performance and operation of squirrel cage and slip ring induction motors.
4. To perform Direct and Indirect tests.
5. To separate the losses of an Induction motor.

Course Outcomes:

After completion of this lab course, the student able to

1. Understand the testing of transformers.
2. Operate the transformers in parallel.
3. Provide supply in industries when 2-phase is required like furnaces by using Scott connection.
4. Analyze the performance characteristics of Induction motors.
5. Draw the equivalent circuits of the transformers and Induction motors.
6. Asses the performance of the given transformers and Induction motors.

List of Experiments:

1. OC & SC tests on single - phase transformer
3. Load test on single - phase transformer
4. Sumpner's test on Transformers
5. Scott Connection of Transformers
6. Parallel Operation of Two Single - Phase Transformers
7. Load test on 3 - phase squirrel cage induction motor
8. Load test on 3 - phase slip ring induction motor
9. No load and Blocked rotor test on 3 - phase induction motor
10. Brake test on single - phase induction motor
11. Determination of Equivalent Circuit of Single - Phase Induction Motor
13. Harmonic analysis of transformer
14. Separation of losses of 3-phase Induction motor
15. Simulation of Parallel Operation of Two Single - Phase Transformers
16. Simulation of Load test on 3 - phase squirrel cage induction motor
17. Simulation of Load test on 3- phase Transformer
18. Simulation of Speed control of 3 –phase Induction Motor

Note: Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations

LERARNING RESOURCES:

1. P.S. Bhimbra, 'Electric Machinery' Khanna Publications, 7th edition.
2. I.J. Nagrath& D.P. Kothari 'Electric Machines ', Tata McGraw - Hill Publishers.

Web references:

1. www.gtbit.org/downloads/emecsem3/emecsem3lmannual.pdf
2. www.centennialcollege.ca/Programs/Documents/.../ECME-123.pdf
3. www.iitk.ac.in/ee/labs/CSL/support_files/EE380_labmanual.pdf
4. www.bcit.ca/study/courses/elex7240

EE 262 :: Pulse and Digital circuits Lab
Semester IV [Second Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

COURSE OBJECTIVES:
1. To understand the practical knowledge on the applications of Linear and Non-linear components such as LPF, HPF, Clippers, Clampers, Oscillator circuits, Multivibrators and Feedback amplifiers.
2. To study the Frequency response and determine the parameters of single-stage and two-stage amplifiers.
3. To understand the applications of and to generate the pulse signals using IC 741 & OP-AMPS.
4. To analyze and Design the Power amplifier circuits.

Course Outcomes:
Upon successful completion of this practical course, the student will be able to:
1. Design the linear and Non-linear wave shaping circuits using active and passive components.
2. Analyze the frequency response and to determine the various parameters of the single-stage and two-stage amplifiers.
3. Persist practical knowledge on the applications of IC's and OP-AMPs.
4. Design the power amplifiers, oscillators and feedback amplifiers.

List of Experiments:
1. Design of RC high pass and low pass circuits for square wave inputs.
2. Design the biased shunt clippers and clampers using diodes and OP-AMPS.
3. To study the frequency response of voltage-shunt amplifier without feedback and with feedback
4. To determine the parameters of Darlington Emitter Follower.
5. To study the Performance analysis of a series voltage regulator using IC 723.
6. Linear applications of OP-AMP (i)Inverting Amplifier (ii) Non-inverting amplifier (iii) Summer (iv) Voltage-Follower (v)Integrator and Differentiator.
7. Generation of Square and Triangular Waves using OP-AMP(LM 741).
8. Design of RC phase shift oscillator.
9. Design of Colpitt's oscillator.
10. Design of LC oscillator
11. Design of UJT relaxation oscillator.
12. Design of Astable Multivibrator and to study its response.
13. Design of Monostable Multivibrator and to study its response.
14. Design of Bistable multivibrator to study its response.
15. Design of Schmitt trigger using BJT.
16. Transformer-coupled Push-Pull Class B amplifier
17. Complementary symmetry Push-Pull Class B amplifier.

Note: Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for semester end examination.

LEARNING RESOURCES:
REFERENCE BOOKS:
1. J.Millman, C.C.Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Ed., 1991.
2. Anil K.Maini, VarshaAgarwal, "Electronic Devices and Circuits",1st Edition, Wiley Publishers,2009.
3. Robert L.Boylested and Louis Nashelsky, "Electronic Devices and Circuit Theory",8th Edition, PHI, 2003.

EE 263 :: Communicative English Lab
Semester IV [Second Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

COURSE OBJECTIVES:

1. To build confidence and enable students speak better English.
2. To motivate students to use English in different situations and contexts.
3. To enable students understand the importance of preparation and practice in presentations.
4. To enable them to understand the basic nuances for effective language communication.
5. Practice comprehensible pronunciation of English.

COURSE OUTCOMES:

Upon completion of the course students shall.

1. Recognise the need of good communication skills for professional courses.
2. Understand the basic tenets of communication.
3. Articulating syllables clearly, speaking fluently with correct pronunciation.
4. Develop their self-awareness.
5. Understand the importance of group dynamics.

UNIT I (7)

Basics of Presentations
Ice breaking session
Student Presentation-I
Learning about Presentations
> - Presentation structure
> - Managing nerves in a presentation
> - Mini Presentations
> - Feedback on presentations

UNIT II (7)

Professional and Personal Grooming
Functional English
Non Verbal Communication
Stage Manners
Understanding and preparing a Presentation
Team presentations

UNIT III (7)

Speech Nuances
Pronunciation
MTI-Mother Tongue Influence
Stress in English
Tempo of Speech
Indianisms and Often Made Mistakes
Idioms & Phrasal verbs

UNIT IV (7)

Free Talk
Dilemma Questions
Paraphrasing an article or a video in student's own words(Team task)
Impromptu speeches
Introducing TED TALKS
Movie based Learning-Karate Kid Movie-Understanding Life Skills

LEARNING RESOURCES:

REFERENCE BOOK(s):

1. Making Successful Presentations :A Self-Teaching Guide-Terry C. Smith,19846
2. Professional Presentations -Malcom Goodale
3. Giving Presentations -Jo Billingham
4. APA ART Speak Well I
5. HANDOUTS

EE 311 :: Control Systems

Semester V [Third Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

Main objectives of this course are

1. To provide sufficient theoretical and analytical background to understand the concepts of control systems and to learn the mathematical applications related to control systems
2. To develop skills for applying them in future on various engineering applications
3. To analyse and design of feedback control systems
4. To give an idea on state space analysis, modelling and analysis of linear control systems using state space representation

Course Outcomes

Upon completion of the course, student will be able to:

1. Model the physical systems and obtain their transfer functions
2. Describe the concepts of continuous time linear control systems and assess the stability of feedback control system with classical approach.
3. Design simple control systems and modify the parameters to meet specific requirements
4. Model and analyze linear control systems using state space approach
5. Connect the course content to real time applications in various electrical and electronics engineering applications

Course Content

UNIT – I **[Text book-1] (13)**

Introduction: Basic concept of simple control system – open loop – closed loop control systems. Effect of feedback on overall gain – stability sensitivity and external noise.

Types of feedback control systems – Liner time invariant, time variant systems and nonlinear control systems

Mathematical models and Transfer functions of Physical systems: Differential equations – impulse response and transfer functions – translational and rotational mechanical systems. Transfer functions and open loop and closed loop systems. Block diagram representation of control systems – block diagram algebra – signal flow graph – Mason's gain formula

Components of control systems: DC servo motor – AC servo motor – synchro transmitter & receiver

UNIT – II **[Text book-1] (15)**

Time Response analysis: Standard test signals – step, ramp, parabolic and impulse response function – characteristic polynomial and characteristic equations of feedback systems – transient response of first order and second order systems to standard test signals.

Time domain specifications - steady state response – steady state error and error constants. Effect of adding poles and zeros on over shoot, rise time, band width – dominant poles of transfer functions.

Concepts of Stability: Absolute, relative, conditional, bounded input –bounded output, zero input stability, conditions for stability, Routh –Hurwitz criterion.

UNIT –III **[Text Book 1] (15)**

Root locus Technique: Introduction – construction of root loci

Stability in frequency domain: Introduction – correlation between time and frequency responses – polar plots – Bode plots – Nyquist stability criterion – Nyquist plots. Assessment of relative stability using Nyquist criterion – closed loop frequency response.

UNIT –IV **[Text Book 1] (13)**

Introduction to Compensation Techniques: P,PI,PID Techniques.

State variable analysis: Concepts of state, state variables and state models – Diagonalisation – solution of state equations – state models for LTI systems. Concepts of Controllability and Observability.

Learning Resources:

Text Books:

1. I.J.Nagrath & M Gopal, Control Systems Engineering, New Age International 5th edition, 2009.
2. B.C. Kuo & Farid Golnaraghi, Automatic control systems, Wiley India,8th edition.

Reference Books:

1. Schaum Series, Feedback and Control Systems, TMH, 3rd edition.
2. A.K.Jairath, Problems & Solutions of Control Systems, CBS Problems &Solutions Series, 6th Edition.
3. A. Anand Kumar, Control Systems, PHI, 2nd edition
4. K. Ogata, Modern Control Engineering, PHI, 5th edition, 2010
5. S. Hasan saeed, Automatic Control Systems, 6th Revised Edition, Katson Educational Series.

Web References:

1. users.ece.utexas.edu/~buckman/Svars1.pdf % Reference for state space analysis

2. http://techteach.no/publications/control_system_toolbox/ % Reference for Matlab control system tool
3. http://csd.newcastle.edu.au/simulations/roll_sim.html % Reference for design problem

4. www.dprg.org/tutorials/2003-10a/motorcontrol.pdf % Control system design for robo application

EE 312 :: Microprocessors & Microcontrollers

Semester VI [Third Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To understand the architecture of 8086 family, addressing modes, instruction description and assembler directives of 8086 microprocessors.
2. To develop the programming skills for applying them on various applications.
3. Learning Digital Interfacing, Analog interfacing with 8086.
4. Learning architecture, pin diagram, addressing modes of 8051, instruction set of 8051, counters and timers of 8051, interfacing with 8051.

Learning Outcomes:

1. Use 8086 microprocessor addressing modes, registers and instruction sets while programming.
2. Debug their assembly language programs.
3. Outline the concepts of Digital & Analog interfacing with 8086.
4. Illustrate the architecture, addressing modes, instruction set, counters and timers 8051, interfacing with 8051.

COURSE CONTENT :

UNIT – I **[Text Book-1&2]**

Microprocessor: introduction to microcomputers and microprocessors, introduction and architecture of 8086 family, addressing modes, instruction description and assembler directives of 8086 microprocessors. (16)

UNIT - II **[Text Book-1&2]**

8086 programming and system connections: Program development steps, writing programs for use with an assembler, assembly language program development tools, writing and using procedures and assembler macros.

An example of minimum mode system, and maximum mode of 8086 operation. addressing memory and ports in microcomputer system. 8086 interrupts and interrupt responses. (15)

UNIT - III **[Text Book-1&2]**

Digital Interfacing: Programmable parallel ports, handshake IO, interface Microprocessor to keyboards. DAC principle of operation, specifications and different types of DACs and interfacing.

Analog Interfacing: A/D converter specifications, types, interfacing to different types of A/D converters.

Programmable devices: Introduction to Programmable peripheral devices 8254, 8259, 8251, DMA data transfer, RS232 communication standard. (13)

UNIT - IV **[Text Book-2&3]**

Introduction:-Introduction to microcontrollers, comparing microprocessors and microcontrollers, Architecture:- Architecture of 8051, pin configuration of 8051microcontroller, hardware input pins, output pins ports and external memory, counters and timers, serial data input and output and interrupts. Programming & interfacing 8051:- Addressing modes of 8051 microcontroller, Instruction set of 8051 microcontroller ,Simple programs using 8051 microcontroller. (16)

LEARNING RESOURCES

TEXT BOOKS:

1. Duglus V. Hall, Microprocessor and Interfacing, Revised 2nd Edition, TMH,2006.
2. A.K.RAY Advanced Microprocessors and peripherals.
3. Kenneth J. Ayala, The 8051 Microcontroller Architecture Programming and Applications, 2nd Edition, Penram International Publishers (I), 1996.

REFERENCE BOOKS:

1. John Uffenbeck, The 80X86 Family, Design, Programming and Interfacing, 3rd Edition, Pearson Education, 2002.
2. Barry Bray, the intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium processors, architecture, programming, and interfacing, 6th Edition, PHI edition. Mohammed Ari Mazidi and Janci Gillispie, The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, New Delhi, 2003.

WEB REFERENCES:

1. https://nptel.ac.in/content/storage2/courses/106108100/pdf/Teacher_Slides/mod1/M1L3.pdf

https://www.youtube.com/watch?v=K8q7kT6CvVE&list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3&index=6

EE 313 :: Synchronous & Special Machines

Semester V [Third Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide students with strong foundation on the classification, construction, performance, testing and applications of synchronous Machines.

2. To enable the students to have a fair knowledge about construction, working principle, operation and applications of Special Machines.

Course learning outcomes:

Upon successful completion of the course, the student will be able to:

1. Describe the Construction, Working principle of operation of three phase Synchronous Generator and analyze the methods of determining the Voltage Regulation.
2. Outline the specifications of synchronous generators and solve problems involving synchronous machines operating alone or in parallel.
3. Illustrate the Three phase synchronous Motor operation, Characteristics, Performance and Applications.
4. Describe the principle of operation, Construction and Applications of single phase ac series motor and Single Phase Synchronous Motors.
5. Outline the Construction, Operating principles and Applications of Stepper Motors, BLDC Motor, Switched Reluctance Motor and Liner Induction Motor

UNIT - I [Text Book- 1&3]

Synchronous Generators: Construction, Excitation Systems – DC Excitation, AC Excitation and Brushless Excitation, EMF-Equation with sinusoidal flux - winding factors - harmonics in generated voltage and their suppression - armature reaction - synchronous impedance – vector diagram - load characteristics - methods of determining regulation – direct load - EMF, MMF, ZPF and ASA. (19)

UNIT - II [Text Book- 1 &2]

Blondel two reaction method for salient pole machine - phasor diagram - slip test - regulation of salient pole machines - parallel operation - synchronizing with infinite bus bars - synchronizing power - effect of variation of excitation and mechanical input on parallel operation – load sharing - losses and efficiency. (15)

UNIT - III [Text Book- 1&2]

Synchronous Motor: Theory of operation - starting methods – phasor diagrams - variation of current and power factor with excitation – minimum and maximum power for a given excitation and power circles - V and inverted V curves - hunting and its prevention - synchronous condenser and its applications. (14)

UNIT - IV [Text Book- 2 & 3]

Single Phase Series (Universal) motors: Principle of operation and characteristic of AC series motors - Repulsion motors and its applications.

Single phase Synchronous motors: Basic concepts and principle of operation and applications of reluctance motor and hysteresis motor.

Stepper Motors: Construction, Principle of operation & Application of Variable Reluctance Stepper Motor - Permanent Magnet Stepper Motor.

Other Special Motors: Construction, Principle of operation & Application of BLDC Motor, Switched reluctance motor, Principle of Operation of Linear Induction Motor and its Applications. (12)

LEARNING RESOURCES:

TEXT BOOKS:

1. Electric Machinery by P.S. Bhimbra, Khanna Publications 7th edition.

2. Electric Machines - by I.J. Nagrath& D.P. Kothari, Tata McGraw-Hill Publishers, 3rd Edition 2004.

3. Theory & Performance of Electrical Machines by J.B Gupta, S.K. Kataria & Sons; Reprint 2013 edition (2013).

REFERENCE BOOKS:

1. Alternating current Machines by A.F. Puchatein, T.C. Lloyd and A.G.Conarad Asia publishing house, 1962.
2. Theory of Alternating Current Machinery by Langsdorf, Tata McGraw-Hill, 2nd Edition.
3. Principles of Electrical machines and power electronics by P.C. Sen John Wiley & Sons 2003
4. Electric Machinery - by A.E. Fitzgerald, C.Kingsley and S.Umans, McGraw-Hill Companies, 6th edition, 2003.

WEB REFERENCES:

1. http://www.nptelvideos.com/electrical_engineering/
2. http://nptel.iitm.ac.in/
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Roorkee/Electrical%20Machines %202 %20%28Video%29.html
4. http://www.creativeworld9.com/2011/02/learn-electrical-machines-iiithrough.html

EE 314 :: Transmission & Distribution
Semester V [Third Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To calculate transmission line parameters.
2. To discuss the theory and mechanical design of transmission lines and introduce various types of distribution systems.
3. To introduce various types of insulators and their testing.
4. To teach various design considerations and theory of underground cables.
5. To explain rigorous theory on substation practice, different protective devices used in substations, transmission systems.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Describe the types of conductors used for electrical system, classify transmission lines and solve problems related to inductance and capacitance.
2. Analyze the performance of short, medium and long transmission lines and design the transmission system with minimum volume of conductor material.
3. Classify the types of insulators, testing of insulators and calculation of string efficiency.
4. Illustrate the types of cables and theory of underground cables, types of substations.

COURSE CONTENT:

UNIT - I [Text books-2&3] (13)

Transmission line parameters: Expressions for inductance and capacitance of single phase and 3- phase lines of symmetrical and transposed configurations.

Concept of self GMD (GMR) and mutual GMD - double circuit lines and bundled conductors - effect of ground on capacitance - line charging KVAR calculations, inductive interference.

UNIT - II [Text books-2&3] (13)

Transmission line theory: Short, medium and long lines – regulation and efficiency - π, T and rigorous methods of solution - ABCD constants. Surge impedance loading - Ferranti effect.

Distribution: Comparison of copper efficiencies between DC , AC Single phase, 3-phase, 3-wire & 4-wire systems - calculation of voltage regulation in case of non-uniform and uniformly distributed loads on feeders – feeders fed at one end and both ends - ring feeders without and with interconnections.

UNIT - III [Text books-2&3] (13)

Insulators: Types of insulators - voltage distribution in a string of suspension insulators, Failure of insulator and testing.

Travelling wave Phenomenon: Travelling waves on transmission lines, attenuation of travelling waves. Protection against travelling waves**:** Rod gaps - sphere gaps – different types of arrestors and surge absorbers.

UNIT – IV [Text books-2&3] (13)

Underground Cables: Types of cables - laying of cables – insulation resistance - electric stress and capacitance of single core cable - use of inter sheath,-Capacitance grading - capacitance of three core belted type cable - stress in a three core cable - sheath effects - currents in bonded sheaths - electrical equivalent of sheath circuit – thermal characteristics of cables.

Substation Practice: Classification of substations - indoor and outdoor substations - busbar arrangements - single busbar - sectionalized single busbar - main and transfer busbar system - sectionalized double busbar system - ring mains - group switching. Substation layout showing the location of PT's and CT's - lightening arrestors, earth switches, isolators, circuit breakers and auxiliaries.

LEARNING RESOURCES:

TEXT BOOKS:

1. W.D. Stevenson, Elements of Power system analysis, TMH 4th Edition.
2. C.L. Wadhwa, Electrical power systems, New Age Intl. (P) Limited 3rdEdition.
3. Sivanagaraju and Satyanarayana, Electric power transmission and distribution, Pearson Education.

REFERENCE BOOKS:

1. H. Cotton, Transmission and Distribution,B. I. Publishers, New Delhi, 1998
2. S.N. Singh, Electric Power Generation, Transmission & Distribution, PHI,2003.
3. D.P. Kothari & I.J. Nagrath, Modern power system analysis, TMH, 3rd edition, 2003.

WEB REFERENCES:

1. https://www.electrical4u.com/materials-used-for-transmission-line-conductor/
2. https://www.electricaleasy.com/2016/03/basics-of-electrical-power-transmission.html
3. https://learn.pjm.com/electricity-basics/transmission-distribution.aspx
4. https://www.sciencedirect.com/book/9780080969121/transmission-and-distribution-electrical-engineering

EE 351 :: Control Systems Lab

Semester V [Third Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

Main objectives of this course are

1. To know the significance of P, PI, PID controllers used in design of control system.
2. To understand the operating characteristics of servo motors, position control system.
3. To check the frequency response of first and second order systems.
4. To find transfer function of DC Motor.

Course Outcomes

1. Design a linear control system to meet required specifications.
2. Check frequency responses of higher order systems in addition to first and second order.
3. Operate servo motors and synchro's used for various applications in industry.
4. Use control systems tool box in MATLAB.

LIST OF EXPERIMENTS:

1. Time response of second order systems.
2. Characteristics of synchros.
3. Effect of feedback on D.C servomotor.
4. Transfer function of D.C motor.
5. Effect of P, PD, PID controller on a second order system.
6. Simulation of transfer functions using operational amplifier.
7. Lag and lead compensation - Magnitude and phase plot.
8. Transfer function of D.C generator.
9. Temperature controller using PID.
10. Characteristics of magnetic amplifier.
11. Characteristics of A.C servo motor.
12. Stepper motor control.
13. D.C. position control.
14. P, PI, PD, PID control using Op-Amps.
15. Frequency response of first and second order systems.
16. To study PLC systems

Note: Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for End Semester Examination.

LEARNING RESOURCES:

REFERENCE BOOKS:

1. Control systems engineering by I.J. Nagrath & M. Gopal, New Age publisher, 5/E.
2. Control systems by A. Ananda Kumar, PHI.

WEB REFERENCES:

1. www.wikipedia.com
2. http://nptel.iitm.ac.in

EE 352 :: Microprocessors & Microcontrollers Lab

Semester VI [Third Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

1. To develop the microprocessor and microcontroller based programs for various applications.

Course Outcomes:
Upon completion of the course the student will be able to

1. Develop programs on the 8086 microprocessors and 8051 microcontroller.
2. Interface 8086 microprocessor and 8051 microcontroller for various simple applications

LIST OF EXPERIMENTS:

Experiments Based on ALP (8086)

1. Programs on Data Transfer Instructions.
2. Programs on Arithmetic and Logical Instructions.
3. Programs on Branch Instructions.
4. Programs on Subroutines.
5. Sorting of an Array.
6. Programs on Interrupts (Software and Hardware).
7. 8086 Programs using DOS and BIOS Interrupts.

Experiments Based on Interfacing with 8086 and Experiments Based on Microcontroller (8051)

8. DAC Interface-Waveform generations.
9. Stepper Motor Control.
10. Keyboard Interface / LCD Interface.
11. Data Transfer between two PCs using RS-232 C Serial Port
12. Programs on Data Transfer Instructions using 8051 Microcontroller.
13. Programs on Arithmetic and Logical Instructions using 8051 Microcontroller.
14. Applications with Microcontroller 8051.

NOTE: A minimum of 10(Ten) experiments, choosing 5 (Five) from each part, have to be Performed and recorded by the candidate to attain eligibility for End Semester Examination.

EE 353 :: SYNCHRONOUS & SPECIAL MACHINES LAB

Semester V [Third Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

1. To develop experimental setups for studying the performance and operation of synchronous generators.
2. To develop experimental setups for studying the performance and operation of synchronous motors.
3. To develop experimental setups for studying the performance and operation of special machines.

Course learning outcomes:

Upon successful completion of the course, the student will be able to:

1. Examine performance of alternators using various methods.
2. Analyse the performance of synchronous motors
3. Assess direct and quadrature axes' reactance for a given synchronous machine
4. Inspect the parameters of special motors.

List of Experiments:

1. Load test on alternator – for UPF, Inductive and Capacitive loads
2. Regulation of alternator by synchronous impedance and MMF methods
3. Regulation of alternator by ZPF & ASA methods
4. Synchronization of alternator with infinite bus – P and Q control
5. Parallel operation of two synchronous machines
6. V and inverted V curves of synchronous motor
7. Synchronous motor performance with constant excitation
8. Separation of losses in single-Φ transformer by V/F method
9. Measurement of Xd and Xq of a three phase alternator by slip test
10. Load test on Universal motor
11. Measurement of Xd" and Xq" of a three phase alternator
12. Load test on 1-Φ synchronous reluctance motor
13. Power factor correction using synchronous motor
14. Load test on hysteresis motor
15. Load test on 1-Φ repulsion motor

Note: Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for University Examinations.

Text Books:

1. P.S. Bhimbra, 'Electric Machinery' Khanna Publications, 7th edition.
2. I.J. Nagrath& D.P. Kothari 'Electric Machines ', Tata McGraw - Hill Publishers.
3. Theory & Performance of Electrical Machines by J.B Gupta, S.K. Kataria & Sons; Reprint 2013 edition (2013).

Web References:

1. www.gtbit.org/downloads/emecsem3/emecsem3lmannual.pdf
2. www.centennialcollege.ca/Programs/Documents/.../ECME-123.pdf
3. www.iitk.ac.in/ee/labs/CSL/support_files/EE380_labmanual.pdf
4. www.bcit.ca/study/courses/elex7240

EE 321 :: Power Electronics

Semester V [Third Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide sufficient knowledge about theoretical and analytical background to understand the concepts of various Power Electronics devices.
2. To provide sufficient knowledge about various power electronic converters.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Compare characteristics of switching devices
2. Evaluate the performance of rectifiers
3. Analyze DC-AC Inverters
4. Analyze DC-DC converter with given characteristics
5. Evaluate the operation of Cycloconverters and AC Voltage Controllers

COURSE CONTENT:

UNIT-I [Text Book- 1, 2] (12)

Power devices: SCR - Theory of operation of SCR - Two transistor model of SCR - Characteristics and ratings - SCR turn on and turn off methods - Firing circuits R, RC, UJT and Ramp comparator Firing circuits. Protection of SCR - Series and parallel operation of SCRs.

P-N-P-N devices: SCS, LASCR, DIAC, TRIAC, GTO characteristics.

UNIT-II [Text Book- 1] (12)

Single Phase Converters: Principles of phase controlled converter operation – single phase half wave converters - single phase half controlled converter and single phase fully controlled converters with R, RL types of loads. Effect of freewheeling Diode - single phase dual converter. Effect of source inductance.

Three Phase Converters: Three phase half wave converters and three phase full wave converters with R, RL loads - three phase dual converter. Effect of source inductance.

UNIT-III [Text Book- 1, 2] (12)

Single Phase Inverters: Principle of inverter operation - single phase half and full bridge inverters- Mc Murray Bedford half bridge inverters.

Three Phase Inverters and PWM Techniques: Three phase inverters (120,180 modes of operation), single phase PWM Techniques-single, multiple and sinusoidal PWM, three phase sinusoidal PWM. **AC Voltage Controllers:** Single phase AC voltage controllers –two SCR's in anti parallel – With R and RL loads. Derivation of RMS load voltage, current and power factor.

UNIT-IV [Text Book- 1, 2] (12)

Choppers: Principle of choppers - Time ratio control and Current limit control strategies, step up and step down choppers -different classes of chopper circuits (Principle of operation only). Applications of choppers. Steady state time domain analysis of type-A chopper. voltage commutated and current commutated chopper (Principle of operation only).

Cycloconverters: Principle and operation of single - phase mid-point and Bridge type cyclo converters with R and RL loads. Applications.

Learning Resources:

Text Books:

1. M.D. Singh and Khanchandani,' Power Electronics' TMH, 2nd Edition.
2. P.S. Bhimbra, 'Power Electronics' Khanna publications, 3rd Edition, 2006.

Reference Books:

1. M.H. Rashid,'Power Electronics, circuits, devices and applications' Pearson'3rd edition, 2005.
2. W.C. Launder, 'Power Electronics' McGraw-Hill 3rd edition,1993.
3. Vedam Subramanyam, 'Power Electronics', New Age International (P) Limited, 2ndedition 2006.

Web Resources:

1. www.powerelectronics.com; % reference for applications
2. www.mypptsearch.com/search-ppt/High%l % Reference for design problems
3. www.ieee.org/conferences_events/confe % for additional references on latest developments
4. http://nptel.ac.in/courses/108101038/ % NPTEL course for power electronics

EE 322 :: Measurements and Instrumentation
Semester VI [Third Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To give overall view to the students regarding different measurement techniques employed in industrial applications.
2. To discuss about various instruments used in electrical measurements.
3. To make the student to understand the process of measuring resistance, inductance and capacitance during electrical engineering practice.
4. To discuss the layouts of digital instruments, oscilloscopes and transducers.

Learning Outcomes:

1. Describe the types and principle of operation of various analog and digital instruments used in laboratories and field practice.
2. Explain the operation and maintenance of CTs and PTs.
3. Measure resistance, inductance, and capacitance parameters of various ranges by selecting appropriate techniques.
4. Choose or design various circuits including magnetic materials for a variety of applications in electrical industry.
5. Identify and operate various digital instruments, oscilloscopes, transducers, thermocouples etc. used in latest equipment, industries and advanced laboratories.

COURSE CONTENT :

UNITI **[Text Book- 1&2]**

Instruments: Classification of instruments - Construction and principle of operation of Permanent magnet moving coil - range extension of PMMC ammeter and voltmeter moving- iron instruments- single phase and three phase dynamometer type watt-meters - induction type of energy meter (13)

UNIT – II **[Text Book- 1&2]**

Construction and principle of operation of Power factor meters - frequency meters and synchroscope.
Magnetic Measurements: Ballistic galvanometer -- B-H loop - flux meter - measurement of permeability.
Oscilloscope : Basic operation - deflection mechanism - time base circuits - vertical amplifiers - alternate and chop modes - applications, Digital storage oscilloscope - Principle and block diagram (11)

UNIT – III **[Text Book- 1&2]**

Instrument Transformers: CTs, PTs principle of operation - errors testing.
Bridges: Measurement of inductance, capacitance and resistance by bridge methods - Maxwell's - Anderson's - Wien's - Schering's Heaviside's - Campbell's - Kelvin's double bridge. Measurement of high resistance by Price's guard wire, loss of charge methods. (11)

UNIT- IV **[Text Book- 1&2]**

Digital Instruments: Principle of operation of DVM's – Types of DVM's
Transducers: Principles - LVDT - thermister - thermo couple- strain gauge and Hall effect tranceducer. (12)

LEARNING RESOURCES:

TEXT BOOKS:

1. Electrical & Electronic Measurement & Instruments by A.K.Shawney, Dhanpat Rai & Co 17th edition 2000.
2. Electrical Measurements and measuring Instruments - by E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing, 1999.

REFERENCE BOOKS:

1. Electrical Measurements - by Buckingham and Price, Prentice - Hall, 1961
2. Electrical Measurements by Harris John Wiley.
3. Electrical Measurements: Fundamentals, Concepts, Applications - by Reissland, M.U, New Age International (P) Limited, Publishers.

WEB REFERENCES:

1. http://nptel.iitm.ac.in/video.php?courseId=1062
2. http://physics.kenyon.edu/EarlyApparatus/Titlepage Electrical _Measurements.html
3. http://en.wikipedia.org/wiki/Electrical_measurements

EE 323 :: Linear ICs and Applications

Semester VI [Third Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

- To enable the students to understand the fundamentals of integrated circuits and designing electronic circuits using it

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Describe the basics of linear integrated circuits and operational amplifiers with applications.
2. Design wave shaping circuits & Oscillators for particular application.
3. Explain the usage and applications of analog to digital converters (ADC) & digital to analog converters (DAC) & design simple filter circuits.
4. Design stable voltage regulators and illustrate the applications of PLL and special ICs.

COURSE CONTENT:

UNIT - I [Text Book-1, 2] (15)

OPERATIONAL AMPLIFIERS: Introduction to differential amplifiers using BJT's, Operational amplifier block diagram representation and ideal characteristics, its equivalent circuit & transfer characteristics, op-amp with negative feedback. Representation & analysis of voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifier with one op-amp, input offset voltage, input bias current, input offset current, total output offset voltage, frequency response of op-amp, stability, slew rate.

COMPARATORS: Introduction to comparator, Basic comparator, Zero crossing detector, Schmitt Trigger, Comparator characteristics, Limitations of Op-Amps as comparators, Voltage limiters.

UNIT - II [Text Book-1, 2] (15)

OP-AMP APPLICATIONS: The summing amplifier, Differential and instrumentation amplifiers, Voltage to current and current to voltage conversion, Differentiators and integrators, Non Linear Op Amp circuits, Precision rectifiers, log amplifier.

CLIPPERS & CLAMPERS: Positive and negative clippers, Positive and negative campers, Absolute value output circuit, Peak detector, Sample and hold circuit.

OSCILLATORS: Oscillator principles, Oscillator types, Frequency stability, Phase shift oscillator, Wein bridge oscillator, Quadrature oscillator, Square-wave generator, Triangular wave generator, Saw tooth wave generator.

UNIT – III [Text Book-2] (15)

CONVERTERS: D/A conversion fundamentals, weighted resistor summing D/A Converter, R-2R Ladder D/A converter. A/D conversion: Parallel (flash) A/D converters, Dual slope converters, Tracking A/D converters, Successive Approximation A/D converters.

ACTIVE FILTERS: Active LP and HP filters, Band pass filters: Wideband, Narrow Band pass filters, Band stop filters, all pass filters, and State variable filters.

UNIT - IV [Text Book-2] (15)

SPECIAL ICs: The 555 timer, 555 as Monostable and Astable Multivibrator and applications.Ic 566 voltage controlled oscillator, Phase Locked Loops, Operating principles, Monolithic PLLs, 565 PLL applications.

APPLICATION ICs: IC Voltage Regulators- LM317, 723 Voltage Regulators, Isolation amplifiers, Opto coupler, Opto electronic ICs

LEARNING RESOURCES:

TEXT BOOKS:

1. Rama Kant A. Gayakwad, Op-Amps and Linear Integrated Circuits, 4th Edition, PHI/ Pearson Education, 2003.
2. D. Roy and Choudhury, Shail B.Jain, Linear Integrated Circuits, 2hd Edition, New Age International, 2003.

REFERENCE BOOKS:

1. Jacob Millman, Christos C.Halkies, 'Integrated Electronics - Analog and Digital circuits system.. Tata McGraw Hill, 2003.
2. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs'. Pearson Education, 4th edition,2002 / PHI.
3. David A.Bell, 'Op-amp & Linear ICs'. Prentice Hall of India, 2nd edition, 1997.

WEB REFERENCES.

1. www.opamp-electronics.com
2. https://www.sonoma.edu/users/m/marivani/es231/units/experiment_0
3. www.stanford.edu/class/ee281/handouts/lecture4.pdf
4. http://frankshospitalworkshop.com/electronics/documents/ Electronc_Devices_And_Ci rcuits. Pdf

EE 324 :: Power System Analysis & Stability

Semester VI [Third Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide students with sufficient theoretical and analytical background to understand the analysis of power system in steady state.
2. To make the student to learn the representation of PU system, symmetrical components, sequence networks fault analysis and stability assessment.
3. To develop skills for applying them in future on various engineering applications.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Draw one line diagrams and understanding of solving per unit computations.
2. Identify operation of grid connected synchronous machine and select capacity of protective devices.
3. Solve problems related to power systems faults.
4. Assess stability of power system network.
5. Relate the course content to real time applications in various electrical and electronics engineering applications.

UNIT - I [Text Book- 1] [CO: 1] **(11)**

Representation of power systems: One line diagram - Impedance and Reactance diagrams.

Per unit quantities - changing the base - selection of base - per-unit impedances of three winding transformers – Advantages of per-unit computations.

UNIT - II [Text Book-1, 2] [CO: 2, 5] **(15)**

Symmetrical Faults: Transients in RL series circuit - short-circuit currents and reactances of synchronous machines - internal voltages of loaded machines under transient conditions – symmetrical fault analysis using thevenin's theorem-selection of circuit breakers

Symmetrical components and Networks: Introduction - operator 'a' - resolution of three unbalanced phasors into symmetrical components - power in terms of symmetrical components.

Sequence impedances and sequence networks of unloaded generators, circuit elements. Positive negative and zero sequence networks.

UNIT - III [Text Book-1, 2] [CO: 2, 5] **(9)**

Unsymmetrical Faults: Single line to ground - line to line and double line to ground faults on an unloaded alternator.

Unsymmetrical faults on power systems - single line to ground, line to line and double line to ground faults. Interpretation of the interconnected sequence networks.

UNIT – IV [Text Book-2] [CO: 3, 4] **(12)**

Power system stability: Introduction - steady state stability, Transient stability, Power angle equation of a synchronous machine, Review of machine swing equation - Equal area criterion of stability – applications: Sudden change in mechanical input, Sudden loss of one of parallel lines, Sudden short circuit on one of parallel lines.

Step by step solution of the swing equation – factors affecting stability.

LEARNING RESOURCES:

TEXT BOOKS:

1. Elements of power system analysis by W D Stevenson Jr Fourth Edition TMH International student edition.
2. Modern power system analysis by D.P. Kothari and I.J. Nagrath , TMH 3rd edition.
3. Electrical power systems by C.L. Wadhwa, New age International (P) Limited

REFERENCE BOOKS:

1. Power system stability by KimbarkVol - I Willey Publications , Inc.
2. Power system stability and control by P. Kundur , TMH.
3. A.R. Bergen and V. Vittal; "Power System Analysis", Pearson Publication.

WEB REFERENCES:

1. http://www.site.uottawa.ca/~rhabash/ELG3311L11.pdf %Reference for one line diagrams
2. http://www.oocities.org/engrabda/aps/p/20.html %Reference for Impedance/ Reactance diagrams
3. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/chapter_6/6_7.html %Reference for symmetrical faults
4. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/chapter_8/8_1.html %Reference for Unsymmetrical faults
5. http://www.mkpalconsulting.com/files/stabilitybook.pdf %Reference for Power system stability

EE 361 :: Power Electronics Lab

Semester V [Third Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

1. To make the students to design triggering circuits of SCR.
2. To introduce power electronics components from which the characteristics of SCR, TRIAC, IGBT and MOSFET are obtained.
3. To perform the experiments on various converters.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Compare and study the characteristics of various power electronic devices
2. Illustrate the operation, application and design various power electronic converters.
3. Design required drive circuits for project work.

LIST OF EXPERIMENTS:

1. Static characteristics of SCR, Triac
2. Characteristics of MOSFET & IGBT
3. Gate triggering methods for SCR's (R, R-C, UJT)
4. Characteristics of Single phase fully controlled rectifier with R, RL & RLE load (with or without feedback diode)
5. Characteristics of Voltage commutated DC chopper
6. Characteristics of single – phase AC voltage controller with R&RL loads
7. Characteristics of single - phase Cyclo-converter (Center tapped or Bridge)
8. Characteristics of single - phase full wave McMurray Bedford inverter
9. Characteristics of Single phase dual converter
10. Characteristics of Three phase fully controlled rectifier with R, RL and RLE loads
11. Speed control of Universal motor
12. Characteristics of Morgan's chopper
13. Characteristics of PWM Inverter based three phase Induction motor.
14. Speed control of induction motor using three phase AC voltage controller
15. Speed control of DC motor using 4 quadrant Chopper

Note: Minimum of ten experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Examinations

LEARNING RESOURCES:

TEXT BOOKS:

1. M.H. Rashid, 'Power Electronics, circuits, devices and applications', Pearson 3rdedition, 2005
2. M.D.Singh and Khanchandani, 'Power Electronics', TMH, 2nd Edition

REFERENCE BOOKS:

1. P.S. Bhimbra, 'Power Electronics', Khanna publications, 3rd Edition 2006

EE 362 :: Measurements and Instrumentation Lab

Semester VI [Third Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

1. To know the procedures for measuring Resistance, Inductance and Capacitance of different ranges.
2. To perform experiments to measure three phase power, frequency, core losses.
3. To design experiments for calibration of energy meter.
4. To know the industrial practices of Measuring earth resistance, dielectric strength of transformer oil & Testing of underground cables
5. To provide hands on practice with various equipment during workshop practice.

Learning Outcomes:

Upon the completion of this lab the students will be able to

1. Measure various electrical engineering parameters used in engineering practice.
2. Calibrate and check the operation of energy meter.
3. Measure earth resistance.
4. Calculate core losses of magnetic material.
5. Use transformer oil testing kit.
6. Get hands on experience with equipment in workshop practice lab.

LIST OF EXPERIMENTS:

Electrical Measurements:

1. Calibration and testing of single - phase energy meter.
2. Kelvin's Double Bridge - Measurement of resistance - Determination of tolerance.
3. Schering Bridge - capacitance measurement and tan measurement
4. Anderson Bridge - inductance measurement.
5. Measurement of 3-phase active and reactive power in three phase circuits.
6. Measurement of frequency using CRO.
7. Measurement of strain using strain gauge.
8. Tracing of B-H curve using CRO.
9. LVDT characteristics, calibration and displacement measurement.
10. Energy meter calibration by phantom loading.
11. Frequency measurement by Wein's Bridge.
12. Measurement medium resistance using Wheatstone Bridge.
13. Measurement of dielectric strength of transformer oil by transfer oil testing kit.
14. Assembling and testing of AC regulator and 3 point starter.
15. Industrial Wiring.
16. Assembling and testing of Ceiling fan.
17. Assembling and testing of various components of fluorescent lamp.
18. Binding of insulators.
19. Substation layout & Design of UG cable.
20. Identification of terminals of DC compound motor.
21. Fault identification and location in underground cables.
22. Measurement of earth resistance by earth resistance tester & fall of potential method.

NOTE: A minimum of 10(Ten) experiments, choosing 5 (Five) from each part, have to be Performed and recorded by the candidate to attain eligibility for End Semester Examination.

LEARNING RESOURCES:

REFERENCE BOOK: 1. Electrical & Electronic Measurement & Instruments by A.K.Shawney Dhanpat Rai & Co 17th edition 2000.

EE 363 :: Electronics Design Lab
Semester VI [Third Year]

L	T	P	C	Int	Ext
1	-	2	2	40	60

Course Objectives:

1. Collect the knowledge of architecture of ARM 7 processor.
2. Learn to program, verify, analyze and troubleshoot arm C language programs.
3. Understand the arduino for different applications.
4. Learn to interface ARM 7 processor & arduino with supporting hardware.

Course Outcomes:

At the end of the course, student will be able to

1. Write programs in ARM for a specific Application.
2. Interface and write programs related to memory operations.
3. Write programs for interfacing the display, motor and sensor.
4. Learn arduino programming through examples.

LIST OF EXPERIMENTS

I) ARM Experiments

1. Study of ARM evaluation system.
2. Write a program to toggle all the led to port and with some time delay.
3. Write a program to interface LCD.
4. Write a program to interface Stepper motor.
5. Write a program for interfacing of DC motor.
6. Write a program to study and characteristics of the programmable gain amplifier (PGA).
7. Write a Program realization of low pass, high pass and band pass filters and their characteristics.
8. Write a program to verify Timer operation in different modes.
9. Write a program for digital function implementation using digital blocks.
   A. Counter for blinking LED
   B. PWM
   C. Digital buffer and digital inverter

II) Arduino Experiments

1. Study of ardunio components and IDE.
2. Isolated gate MOSFET driver based DC motor and solenoid driver arduino nano shiled.
3. Multi sensor shield for arduino nano with light, magnetic field & temperature sensor.
4. Serial plotter using arduino.
5. Controlling the speed and direction of DC motor using ardunio.
6. Seven segment display using ardunio.
7. DC voltage , current and power measurement using ardunio.

III) Design & Fabrication of a working model using Arm/ Ardunio/ Any other processor

Text Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.
2. Nigel Gardner, "The Microchip PIC in CCS C". Ccs Inc, 2nd Revision Edition, 2002.

Web References:

1. https://spoken-tutorial.org/tutorial-search/?search_foss=Arduino&search_language=English
2. https://www.electronics-lab.com/projectcategory/projects/arduino/
3. https://www.exploreembedded.com/wiki/

EE 411 :: Industrial drives

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To know about different types of drives and applications in various industries.
2. To acquire the knowledge of different speed control methods in ac and dc motors using static power semiconductor switches based control schemes.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Categorize various drive mechanisms and their closed loop control strategies
2. Design the power electronic converters for AC to DC and DC to DC to control the speed of DC motors
3. Design power electronic converters (AC voltage controllers and VSI) to control the speed of induction motors
4. Assess the usage of power electronic converters to control the speed of synchronous motors & special motors, and illustrate the methods for energy conservation.

COURSE CONTENT:

UNIT - I **[Text Book- 1] (12)**

Introduction of Electric Drives: Electric drives, advantages of electric drive, parts of electric drives, Choice of electrical drives, Status of dc and ac drives.

Dynamics of Electric Drives: Fundamental torque equations, Speed torque conventions and multi quadrant operation, Components of load torques, Nature and classification of load torques, steady state stability.

Control of Electric Drives: Modes of operation, Speed control and drive classification closed-loop control of drives- Current limit control, torque control, speed control, PLL control, position control.

UNIT - II **[Text Book- 1] (12)**

DC motor Drives: conventional Speed control methods (theory only), methods of braking.

Rectifier fed DC Drives: Single phase fully and half controlled rectifier control of separately excited and series dc motor.(Continuous conduction) 3-Φ Controlled Rectifier fed DC Drives: - Three phase fully and half controlled rectifier control of separately excited and series dc motor, Single and three phase Dual converter control of separately excited dc motor.

Chopper fed DC Drives: Control of separately excited dc motors-Motoring (class-A), Regenerative braking (class-B), Motoring and Regenerative braking (class-C), Dynamic braking, Chopper control of series motor.

UNIT - III **[Text Book- 1] (12)**

Introduction to Induction motor drives: Three phase induction motors-analysis and performance, Operation with unbalanced source voltages and single phasing, braking, transient analysis.

Speed control from stator side: Stator voltage control by A.C. voltage controllers, Variable frequency control from voltage sources, VSI control.

Speed control from rotor side: Static rotor resistance control, slip power recovery, Variable speed constant frequency generation.

UNIT - IV **[Text Book- 1] (12)**

Synchronous motor drives: Synchronous motors, Operation from fixed frequency supply-starting, pull-in, braking, Synchronous motor variable speed drives, Self-controlled synchronous motor drives employing load commutated inverter, Self-controlled synchronous motor drives employing cycloconverter.

Special Motor drives: Permanent magnet ac motor drives, brush less dc motor drives, important features and applications of BLDC drive.

Energy Conservation in Electric Drives: Losses in Electric drive systems, measures for Energy conservation in Electric drives, use of efficient converters, use of efficient motors, use of variable speed drives, energy efficient operation of drives, using a motor of right rating.

Learning Resources:

Text Books:

1. G.K. Dubey, 'Fundamentals of Electric drives', Narosa, 2nd Edition, 2001.

Reference Books:

1. G.K. Dubey, 'Power Semiconductor controlled drives', PH, 2nd Edition1989.
2. S.B. Dewan, G.R. Selmon & Straughen, 'Power semiconductor drives' John Wiley, 2009.
3. G.K Dubey, S.R Doradla, 'Thyristorised power controllers' New Age, 1st edition, 1986.

Web Resources:

1. www.siemens.com/Sirius
2. www.minglebox.com
3. www.abb.com
4. www.drives-and-controls.co.uk
5. http://nptel.ac.in/courses/108102046

EE 412 :: Computer Aided power systems analysis

Semester VII [Fourth Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To form incidence matrices and to prepare primitive impedance and admittance matrices with and without mutual coupling.
2. To develop network performance equations and formation of network matrices using singular and non-singular transformations.
3. To teach the methods of mathematical formulation of complex power system and short circuit calculations.
4. To deal with the numerical methods studied in applied mathematics courses to get the solutions of load flow and comparison of different methods.
5. To prepare the student for developing algorithms with the software packages available in order to get the solution of transient stability studies.

Course Outcomes:

After successful completion of the course, the students are able to

1. Examine the power system network to get the primitive data with and without mutual coupling
2. Develop network matrices and be able to conduct short circuit studies.
3. Write algorithms to conduct load flow study on power system network by various techniques.
4. Develop an algorithm for transient stability study and be able to write state equations for turbine and speed governor controls.

UNIT - I [Text Book- 1] **(11)**

Incidence & Network Matrices: Element-node incidence matrix - reduced incidence matrix or bus incidence matrix - basic loop incidence matrix - augmented loop incidence matrix - basic cut set incidence matrix - augmented cut set incidence matrix - branch path incidence matrix - concept of primitive network - primitive impedance and admittance matrices with and without mutual coupling - network performance equations - formation of network matrices using singular &non singular transformation.

UNIT – II [Text Books 1, 2] **(14)**

Algorithm for formation of network matrices & short circuit studies: Formation of bus admittance and bus impedance matrices and respective algorithms - modifications of bus impedance and admittance matrices for changes in the networks with and without mutual coupling - representation of three phase network elements for balanced and unbalanced systems - short circuit calculations for symmetrical and unsymmetrical faults using bus impedance matrix.

UNIT - III [Text Book 1] **(11)**

Formulation of Load Flow Problem: Introduction - non linear equations solution techniques using Gauss iterative, Gauss Seidal and Newton Raphson (rectangular and polar) methods using bus admittance matrix - acceleration of convergence - development of flow charts for load flow problems - comparison of different load flow methods.

UNIT - IV [Text Book 1] **(8)**

Formulation of Transient Stability Problem: Representing synchronous machine by constant voltage behind transient reactance (d- axis) and network by steady state equations - Flow chart for digital simulation of transient stability problem.

Swing equation of a synchronous machine – Block diagram for representation of an exciter control system – Block diagram for a speed governor control system.

Learning Resources:

Text Books:

1. Computer methods in Power System Analysis by Stagg, G.W. & El-Abiad TMH.
2. Advanced Power System Analysis and Dynamics by L.P. Singh Wiley Eastern Ltd., New Delhi 3rd edition 1993.

Reference Books:

1. Modern power system analysis by Nagrath&Kothari TMH 3rd edition.
2. Control and stability of Power Systems by Anderson &Fouad, Iowa state university press.

Web References:

1. ieeexplore.ieee.org/iel5/39/22132/01029972.pdf?arnumber. % reference for applications
2. pec.ac.in/deptt/Elect/7th%20Sem.Elect.pdf % Introductory online tutorials
3. umpir.ump.edu.my/72/1/cd2621.pdf % Reference for Matlab control system tool
4. courses.engr.illinois.edu/ece476/notes/html % Reference for power flow analysis

EE 451 :: Power Systems Lab

Semester VII [Fourth Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

1. To make the students to analyze different types of faults in power systems.
2. To create concepts towards study of existing power network for design of compensation devices.
3. To study the performance of insulators and cables by High voltage testing.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Select and design protective devices for various equipment used in Electrical Industry.
2. Determine impedances of various rotating machines.
3. Design capacitors to improve power factor practically and be able to test HV insulators & cables
4. Determine parameters of transmission line, loading capability, compensation equipment required in practical transmission network.
5. Illustrate the grid interconnection mechanisms of renewable energy resources.

LIST OF EXPERIMENTS:

1. Characteristics of over current relay & Earth fault relay
2. Characteristics of over voltage / under voltage relay
3. Characteristics of differential relay
4. Characteristics of definite time reverse power relay
5. Characteristics of negative sequence relay
6. Sequence impedances of alternator
7. Harmonic analysis using power network analyzer
8. Characteristics of distance relays
9. Power factor correction of induction motor
10. Determination of Transmission line parameters
11. Regulation and efficiency of transmission line including Ferranti effect
12. Reactive power control by tap changing transformers
13. Sequence impedances of transformer
14. Grading of Insulators
15. Compensation of transmission line model
16. H.V. testing of Insulators
17. High voltage testing of cables
18. Grid interconnection of Renewable energy resources

LEARNING RESOURCES:

REFERENCE BOOKS:

1. Nagrath&Kothari, Modern power system analysis, TMH 3rd edition
2. C.L. Wadhwa, Electrical power systems, New age International (P) Limited
3. TK Nagsarkar and Sukhija, Power system analysis, Oxford press

EE 452 :: Simulation Lab

Semester VII [Fourth Year]

L	T	P	C	Int	Ext
-	-	2	1	40	60

Course Objectives:

1. To introduce to students of electrical & electronics engineering branch the simulation of various power electronic circuits, control system circuits and analysis of steady state system for short circuits and stability using different packages available.
2. To simulate converter, chopper, AC voltage controller & inverter circuits using PSPICE.
3. To familiarize the student with control system tool box in MATLAB
4. To simulate power system networks for load flow, short circuit analysis, relay coordination and transient stability using Mi-Power software.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to:

1. Simulate different power electronic circuits using PSPICE.
2. Simulate different control systems problems using MATLAB.
3. Understand analysis of RLC circuits using EMTP.
4. Determine steady state stability analysis, short circuit studies and relay co-ordination of power systems using MIPOWER.
5. Exhibit expertize in usage of modern tools.

LIST OF EXPERIMENTS:

1. Simulation of a single-phase full-bridge converter with different loads
2. Simulation of static characteristics of SCR
3. Simulation of a resonant pulse commutation circuit and buck chopper
4. Simulation of an AC voltage controller with various loads
5. Simulation of single-phase inverter with PWM control
6. Modeling of transformer
7. Transfer function analysis of a given circuit
8. State model representation of transfer functions
9. Plotting of Bode, Nyquist and root-locus plots for transfer functions
10. Steady state and Transient analysis of RLC circuits
11. Short circuit studies in power systems
12. Transient stability analysis of power systems
13. Relay co-ordination in power systems
14. Simulation of two area system
15. Develop a program for Ybus by inspection
16. Develop a program for Zbus using Zbus building algorithm
17. Develop a program for Load flow analysis by Gauss - Seidel method
18. Develop a program for load flow analysis by Newton - Raphson method
19. Develop program for load flow analysis by FDLP method.

Simulation is to be carried out with the following software PSPICE/ MATLAB/ MiPower/ PSIM/ PSCAD/ EMTP.

Learning Resources:

Text Books:

1. Computer methods in Power System Analysis by Stagg, G.W. & El-Abiad TMH
2. Computer Techniques in Power System Analysis by M.A. Pai , TMH 2005
3. Power Electronics, circuits, devices and applications by M.H. Rashid Pearson 3rd edition, 2005
4. Control systems by A. Ananda Kumar, PHI

Web Resources:

1. www.wikipedia.com
2. http://nptel.iitm.ac.in

EE 453 :: Project Stage – 1

Semester VII [Fourth Year]

L	T	P	C	Int	Ext
-	-	4	2	100	--

Course Objectives:

1. To prepare students to express the knowledge they have gained in the areas related to electrical and electronics engineering.
2. To ascertain the students for better communication and organizational skills
3. To identify their research area/topic and complete the preliminary research required for it
4. To train the students to make use of research tools and material available both in print and digital formats.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to:

1. Get practical exposure in the field of Electrical & Electronics Engineering
2. Work together and Identify the topic for project work with his group
3. Define a problem and its analyse the problem for implementation
4. Use the latest computational tools available

Guide Lines:

- At the end of the Semester, as a team - the student should implement and submit a hard ware project along with a report containing implementation details.
- At the end of the Semester, the batch must submit a report and give presentation on the work they have pursued throughout the Semester containing

- The aim and objective of the study.
- The Rationale behind the study.
- The work already done in the field and problem identified.
- Hypothesis, experimentation and discussion.
- Conclusion and further work possible.
- Appendices consisting of Illustrations, Tables, Graphs etc.,

Evaluation will be done for the presentation made and the report submitted

EE 461 :: Project Stage – II

Semester VIII [Fourth Year]

L	T	P	C	Int	Ext
-	-	14	7	40	60

Course Objectives:

Project work is aimed at

1. Implementation of the problem identified in Term Paper EE451
2. Application of theory learned so far in Electrical and Electronics Engineering
3. Make use of research tools and material
4. Consolidation of Hardware/Software skills for a real world /research problem
5. Improvement of problem solving skills
6. Improvement of report writing, word processing skills and documentation skills

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

1. Undertake problem identification, formulation and solution
2. Demonstrate a sound technical knowledge of their selected project topic
3. Develop a prototype solution to industrial/ theoretical problems
4. Function effectively on teams to accomplish a common goal
5. Present their project and Publish paper in National or International conferences

Guide Lines:

The sessional marks shall be awarded based on the weekly progress, the performance in two Seminars and the Project Report submitted at the end of the semester.

EEOL1 :: Renewable energy sources

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To know the depletion rate of conventional energy resources and importance of renewable energy sources.
2. To know alternate viable energy sources to meet the energy requirements.
3. To discuss about solar energy, wind energy, tidal energy and geothermal energy as alternate sources.
4. To know how biogas is produced & digester for power generation.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

1. Illustrate the national scene of energy production, utilization, consumption and energy storage systems.
2. Describe about the basics of solar energy, generation of electricity from solar energy & photovoltaic's.
3. Assess wind energy potential, wind turbines and wind generators.
4. Outline the details of ocean energy, temperature differences & principles, extraction of energy from waves, geothermal, biogas.

COURSE CONTENT:

UNIT - I [Text Book- 1](8)

Principle of Renewable Energy: Comparison of Renewable and Conventional energy sources - Ultimate energy sources - natural energy currents on earth - primary supply to end use - Spaghetti & Pie diagrams - Energy planning - Energy Efficiency and Management.

UNIT - II [Text Book- 2](12)

Solar Radiation: Extra terrestrial solar radiation - terrestrial solar radiation - solar thermal conversion-Solar Thermal Central Receiver system - Photovoltaic energy conversion - solar cell. (only theoretical analysis)

UNIT – III [Text Book- 2](12)

Wind energy: Planetary and local winds - Vertical axis and Horizontal axis wind mills - principles of wind power - maximum power – actual power - wind turbine operation.
(only theoretical analysis)

UNIT - IV [Text Book- 2](12)

Energy from Oceans: Ocean temperature differences - principles of OTEC plant operations - wave energy - devices for energy extraction - tides - Simple single pool tidal system.
Geothermal Energy: Origin and types - Bio fuels - classification – Direct combustion for heat and electricity generator - anaerobic digestion for biogas - biogas digester - power generation.
(only theoretical analysis)

Learning Resources

Text Books:

1. John Twidell & Toney Weir "Renewable Energy Sources" E&F.N. Spon
2. G.D.Rai"Non-Conventional Energy Sources"Khanna Publishers.

Reference Books:

1. EL-Wakil"Power Plant Technology" McGraw-Hill Publications.
2. Abbasi&Abbasi"Renewable Energy Sources" Their impact on global warming and pollution by – PHI.

Web Resources:

1. https://www.eia.gov/energyexplained/renewable-sources/
2. https://www.justenergy.com/blog/7-types-of-renewable-energy-the-future-of-energy/
3. https://www.studentenergy.org/topics/renewable-energy

EEOL2 :: Utilization of Electrical Energy

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To know about the different types of lamps & lighting schemes.
2. To know about the different types electric heating methods.
3. To know the design heating elements such as furnaces and ovens.
4. To know to utilize the electrical energy for production of heat and welding process.
5. To provide specific knowledge on Principles and characteristics of storage batteries.

Course Outcomes:

After successful completion of the course, the students are able to
1. Categorize different types of lamps & lighting schemes.
2. Investigate the mechanisms of electrical heating.
3. Design heating elements such as furnaces and ovens.
4. Illustrate the types and requirements of welding.
5. Outline the types, principles, applications and characteristics of storage batteries.

Course Content:

UNIT I **Text Book - 1 (12)**

Illumination: Introduction- terms used in illumination-laws of illumination - Square law methods of calculation.
Gas discharge lamps - Fluorescent lamps - Arc lamps - Filament lamps - Comparison between filament and fluorescent lamps.

Lighting schemes & Introduction to Electric heating : Factory lighting - flood lighting and street lighting-design of lighting schemes-introduction to Compact Fluorescent Lamps.
Introduction-Modes of heat transfer - Stefan's law - Classification of electric heating methods

UNIT II **Text Book - 1 (12)**

Electric Heating element Design and types of furnaces : Design of heating element - Construction and working of different types of induction furnaces -resistance furnace - arc furnaces.
Dielectric heating, Dipole formation, generation of dielectric heat and applications.

UNIT III **Text Book - 1 (12)**

Welding : Introduction- Types of welding - resistance and arc welding -Characteristics of Carbon and metallic arc welding - comparison, welding equipment.
Requirements of good weld, comparisons of A.C and D.C weld (Excluding electronic controls)

UNIT IV **Text Book - 1 (12)**

Storage batteries : Types of cells. Lead acid cell, Nickel Iron cell, Chemical changes during charging and discharging. Applications - rating - classification-dry cell and wet cells.
Methods of charging & common troubles : Charging and discharging of lead acid cells, methods of charging lead acid batteries - over discharging common troubles with lead acid batteries and remedies - Nickel cadmium batteries.

LEARNING RESOURCES:

TEXT BOOK(s):

1. J.B. Gupta - Utilization Electric Power and Electric Traction, Katson books publishers, Tenth Edition, 2012.
2. Utilization, generation & conservation of electrical energy by Sunil S Rao, Khanna publishers, Sixth Edition, 2005.

REFERENCE BOOK(s):

1. Partab H - Art and Science of Utilization of Electrical Energy, Dhanpat Rai and Sons, New Delhi, Second Edition, 2009.
2. R.K.Rajput - Utilization of Electric Power, Laxmi publications Private Limited, Second Edition, 2013.
3. G.C.Garg - Utilization of Electric Power and Traction, Kanna publishers, Ninth Edition, 2014.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/video.php?subjectId=108105060
2. http://web.mit.edu/lien hard/www/ahttv201.pdf
3. http://www.comp-as.com/pdf/Article03.pdf
4. www.srmuniv.ac.in/downloads/welding.doc

EEOL3 :: Power Converters

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

The main objectives of this course are

1. To provide sufficient knowledge about theoretical and analytical background to understand the concepts of various Power Electronics devices.
2. To provide sufficient knowledge about various power electronic converters.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Compare characteristics of switching devices.
2. Evaluate the performance of AC-DC converters.
3. Illustrate the details of DC-AC Inverters.
4. Analyse and evaluate the operation of AC-AC converters.
5. Illustrate the principle of DC-DC converters, SMPS, UPS.

UNIT -I: [Text Book-1] **[15]**

Power devices: SCR - Theory of operation of SCR – Static Characteristics - SCR turn on methods – Basic structure, operation and characteristics of IGBT and MOSFET.

Principles of phase controlled converter operation – single phase half wave rectifier with R type of load - single phase fully controlled converter with R type of load.

UNIT -II: [Text Book-1] **[15]**

Single Phase Inverters: Principle of inverter operation - single phase half bridge inverter and full bridge inverter with R type of load. Applications of inverters. Single phase PWM Techniques-single, multiple and sinusoidal PWM.

UNIT -III: [Text Book-1] **[15]**

Cycloconverters: Principle and operation of single - phase mid-point and Bridge type cycloconverters with R type of load, Applications. AC Voltage Controllers: Single phase AC voltage controllers –two SCR's in anti-parallel – With R load (Principle of operation), Applications.

UNIT- IV: [Text Book-1 & 2] **[15]**

Choppers: Principle of choppers - step up and step down choppers (Principle of operation).

Working principle of switched mode power supplies (SMPS), applications. Working principle of UPS, applications.

Learning resources:

Text Book(s)

1. Power Electronics by P.S. Bhimbra Khanna publications, 3rd Edition 2006.
2. Power Electronics by M.D.Singh and Khanchandani TMH, 2nd Edition.

Reference Book(s)

1. Power Electronics, circuits, devices and applications by M.H. Rashid Pearson 3rd edition, 2005.
2. Power Electronics by W. Launder 2ndedition,1993.
3. Power Electronics - by VedamSubramanyam, New Age International (P) Limited, 2ndedition 2006.

Web resources:

1. www.powerelectronics.com; % reference for applications
2. www.mypptsearch.com/search-ppt/High%l % Reference for design problem
3. www.ieee.org/conferences_events/confe % for additional references

EEOL4 :: Energy Conservation

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To impart knowledge in the domain of energy conservation.
2. To address the underlying concepts and methods behind Energy conservation management.
3. To inculcate knowledge and skills about assessing the energy efficiency of an entity/ establishment.

Course Outcomes:

1. Describe the concepts of energy management.
2. Analyze energy saving and conservation in electrical and mechanical utilities.
3. Use the knowledge for efficient electricity utilization, saving and recovery in different electrical systems.
4. Develop audit report for different energy conservation instances.

COURSE CONTENT:

Unit I

Reasons for Energy Management, Overview of Energy Management, The Systems Concept, Energy Basics, The Building Structure, Heat Loss and Gain, Energy Use in Buildings, Factors That Affect Building Construction, Products for Energy Conservation, Energy Conservation Checklist for Building Structures.

Unit II

Lighting systems:

Introduction, Characteristics of Light, Types of Lighting, Incandescent Lighting, Fluorescent Lighting, Street Lighting LED Lighting, Lighting Design, Light Dimming, Tips for Energy Conservation Products for Energy Conservation, Energy Conservation Checklist.

Cooling systems:

Introduction, Air-Conditioning-System Classifications, Air-Conditioning Systems, Cooling System Applications, Split Systems, Air-Conditioning-System, Components Efficiencies in Air Conditioning, Refrigerants, Indoor Air Quality, Energy Conservation Checklist for Air Conditioning Systems.

Unit III

Electrical power systems:

Power Distribution Systems, Electrical Power Control, Electrical Power Conversion (Loads), Power-Factor Correction, Electrical Motors, Products for Energy Conservation, Energy Conservation Checklist for Electrical Systems.

Introduction, Types of Solar Energy Systems, Solar Air-Conditioning Systems, Photovoltaic Systems, Domestic Solar Hot-Water Heating, Products for Energy Conservation, Future of Solar Energy, Energy Conservation Checklist for Solar Systems.

Unit IV

Energy management systems:

Introduction, Energy Use in Buildings, Considerations for Effective Energy Management Developing an Energy Management Program, Suggestions for Building Owners and Operators Energy Audit, Energy Audit Checklist, Energy Saving Through Preventative Maintenance, Equipment Scheduling, Computerized Energy Management Systems, Computer Networked Controls, Checklist for Energy Management Systems.

Learning Resources:

Text books:

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press.
2. G. G. Rajan, "Optimizing Energy Efficiencies in Industry", Tata McGraw Hill, 2001.
3. Charles M. Gottschalk, "Industrial Energy Conservation", John Wiley and Sons, 1996.
4. LC Witte, PS Schmidt and DR Brown: Industrial Energy Management and Utilization (Hemisphere Publishing Corporation,Washington,1998)

Reference Books:

1. Kreith, Economics of Solar Energy and Conservation Systems, Vol -3.

2. Sumper Andreas and Baggini Angelo: Electrical Energy Efficiency: Technologies and Applications (John Wiley 2012).
3. WC Turner and Steve Doty: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007)
4. Energy Conservation and Audit by Mr. Amit L. Nehete.
5. Craig B. Smith, "Energy Management Principles", Pergamon Press, 2015.
6. Barney L. Capehart, Wayne C. Turner and William J. Kennedy, "Guide to Energy Management", Seventh Edition, The Fairmont Press Inc., 2012.

Web Resources:

1. http://nptel.iitm.ac.in/
2. National Productivity Council (http://www.npcindia.gov.in)
3. Bureau of Energy Efficiency (https://www.beeindia.gov.in)
3. www.powermin.nic.in
4. www.teriin.org

EEOL5 :: Electric Vehicles

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To present a comprehensive overview of Electric Vehicles, their architecture, technologies and fundamentals.
2. Choose a suitable drive scheme for developing an electric vehicle depending on resources.
3. Discuss different energy storage technologies used for electric vehicles and their control.

Course Outcomes:

After learning the course the students should be able to:

1. Explain the functioning details of Electric Vehicles and recent trends in EV technologies.
2. Illustrate the details of electrical machines used in electric vehicles.
3. Develop the electric propulsion unit and its control for application of electric vehicles.
4. Examine the details and characteristics of different energy storage systems with specific application to EVs.

Course Content:

UNIT-I Introduction to Electric Vehicles

Electric Vehicle System, Components of an EV, EV Advantages, EV Market, Vehicle Mechanics, Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Velocity and Acceleration, Propulsion System Design (Basic Principles only).

UNIT-II DC and AC Electric Machines

Motor Ratings, EV Motor Requirements, DC Machines, Types of AC Machines, Induction Machines, PM Synchronous Motor, PM Brushless DC Motor, Switched Reluctance Machines. (Principle of operation only)

UNIT-III Motor Drives and EV Drive Train

Electric Drive Components, Power Converters, Drive Controller, DC Drives, Two-Quadrant Chopper, AC Drives, VSI, PMSM Drive Structure (Block Diagram only), Converter Topologies for SRM, EV Transmission Configurations, Transmission Components- Gears, Automobile Differential, Clutch, Brakes.

UNIT-IV Alternative Energy Sources

Types of Batteries, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Targets and Properties of Batteries, Fuel Cells, Fuel Cell Characteristics, Types of Fuel Cells, Supercapacitors and Ultracapacitors.

Learning Resources:

Text books:

1. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2005.
2. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2005.
3. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.

Reference Books:

1. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
2. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press, 2001.
3. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011.

List of Open Source Software/learning website:

1. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000. 2. http://nptel.ac.in/courses/108103009/
3. MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems.

EEEL 01 :: Signals and systems

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide sufficient theoretical, analytical background about signals and systems.
2. Make the student to learn about Fourier series and Fourier transformation.
3. To understand the input-output relationships for characteristics of LTI systems and conditions for distortion less transmission.
4. To study Fourier and Laplace Transform analysis for continuous-time LTI systems.
5. To study Z-Transform analysis for discrete time systems.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Explain the mathematical descriptions, representations and classification of continuous and discrete signals and systems.
2. Use Fourier series and Fourier transform techniques for the representation of continuous-time periodic and a periodic signals.
3. Explain the input-output relationships for characteristics of LTI systems and conditions for distortion less transmission.
4. Use Fourier and Laplace Transform analysis for continuous-time LTI systems.
5. Use Z-Transform analysis for discrete time systems.

COURSE CONTENT:

UNIT – I **(TEXT BOOK-1, 2) (15)**

SIGNALS AND SYSTEMS: Introduction, Continuous-Time and Transformations of the independent variable, Exponential and sinusoidal signals, The unit Impulse and Unit step functions, Continuous-Time and Discrete-Time systems, Basic system properties.

SAMPLING: Introduction, Representation of a continuous-time signal by its samples, sampling theorem, Reconstruction of a signal from its samples using interpolation, Aliasing and its effects.

UNIT – II **(TEXT BOOK-1, 2) (15)**

FOURIER SERIES: Introduction, Fourier series representation of continuous-time periodic signals, Convergence of the Fourier series, Properties of continuous-time Fourier series.

FOURIER TRANSFORMS: Introduction, Representation of aperiodic signals: The continuous Fourier transform, The Fourier transform for periodic signals, Properties of the Continuous-time Fourier transform.

UNIT – III **(TEXT BOOK-1, 2) (15)**

LINEAR TIME INVARIANT SYSTEMS: Introduction, LTI systems, Impulse response, Transfer function of a LTI system, Convolution integral, Convolution sum, Energy and Power spectral density, Auto correlation, Cross correlation functions, Properties of correlation functions, Parseval's theorem, Filter characteristics of linear systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and paly-wiener criterion, Relationship between bandwidth and rise time.

UNIT – IV **(TEXT BOOK-1, 2) (15)**

SIGNALS AND SYSTEMS ANALYSIS USING LAPLACE TRANSFORMS: Introduction, The Laplace transform, The region of convergence for Laplace transforms, The inverse Laplace transform, Properties of the Laplace transform, Analysis and characterization of LTI systems using the Laplace transform, The unilateral Laplace transform.

SIGNALS AND SYSTEMS ANALYSIS USING Z-TRANSFORM: Introduction, The Z- transform, The region of convergence for Z-transform, The inverse Z-transform, Properties of the Z-transform, Analysis and characterization of LTI systems using the Z-transform, The unilateral Z-Transform

Learning Resources:

TEXT BOOKS:

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, "Signals & Systems", II edition, PHI Publishers, 1996.
2. P.Ramesh Babu, R Ananda Natarajan, "Signals and Systems", III edition, Scitech Publishers, 2009.

REFERENCE BOOKS:

1. Simon Haykin, Barry Van Veen, "Signals & Systems", II edition, John Wiley & Sons, 2001
2. B P Lathi, "Signals, Systems and Communications", III edition BS Publications, 2003.

Web Resources:

1. http://nptel.ac.in/courses/117104074
2. http://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011

EEEL 02 :: New & Renewable Energy resources

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To know the depletion rate of conventional energy resources and importance of renewable energy sources.
2. To know alternate viable energy sources to meet the energy requirements.
3. To discuss about solar energy, wind energy, tidal energy and geothermal energy as alternate sources.
4. To know how biogas is produced & digester for power generation.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

1. Outline the National scene of energy production, utilization, consumption and energy storage systems.
2. Illustrate the basics of solar energy, collectors & generation of electricity from solar energy & photovoltaic's.
3. Assess the wind energy potential and describe about wind turbines and wind generators.
4. Explain the concepts of ocean energy, temperature differences & principles, extraction of energy from waves, geothermal, biogas.

COURSE CONTENT:

UNIT - I [Text Book- 1](10)

Principle of Renewable Energy: Comparison of Renewable and Conventional energy sources - Ultimate energy sources - natural energy currents on earth - primary supply to end use - Spaghetti & Pie diagrams - Energy planning - Energy Efficiency and Management.

Energy Storage Systems: Pumped Hydro- Compressed air storage-Energy storage by fly wheels-Electrical battery storage-Thermal sensible energy storage-Latent heat energy storage.

UNIT - II [Text Book- 2](12)

Solar Energy: Extra terrestrial solar radiation - terrestrial solar radiation - solar thermal conversion-solar thermal central receiver systems, Solar pond, Distributed systems.

Photovoltaics: Photovoltaic energy conversion - solar cell- Construction- conversion efficiency & output-VI characteristics.

UNIT – III [Text Book- 2](12)

Wind energy: Planetary and local winds - vertical axis and horizontal axis wind mills.

Principles of wind power: maximum power – actual power - wind turbine operation - electrical generator.

UNIT - IV [Text Book- 2](12)

Energy from Oceans: Ocean temperature differences - principles of OTEC plant operations - wave energy - devices for energy extraction - tides - Simple single pool tidal system.

Geothermal Energy: Origin and types - Bio fuels - classification – Direct combustion for heat and electricity generator - anaerobic digestion for biogas - biogas digester - power generation.

LEARNING RESOURCES

TEXT BOOKS:

1. John Twidell & Toney Weir "Renewable Energy Sources" E&F.N. Spon
2. G.D.Rai"Non-Conventional Energy Sources"Khanna Publishers.

Reference Books:

1. EL-Wakil"Power Plant Technology" McGraw-Hill Publications.
2. Abbasi&Abbasi"Renewable Energy Sources" Their impact on global warming and pollution by – PHI.

Web Resources:

1. https://www.eia.gov/energyexplained/renewable-sources/
2. https://www.justenergy.com/blog/7-types-of-renewable-energy-the-future-of-energy/
3. https://www.studentenergy.org/topics/renewable-energy

EEEL 03 :: Power system Protection

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To get the student an idea of zones of protection and various types of relays.
2. To make the student to gain the knowledge of various circuit breakers with their applications.
3. To get the knowledge of differential protection of various power system network elements.
4. To make the student to understand the principle of static relays and their applications.
5. To make the student to understand the concept of grounding, soil resistivity and earth resistance.

Course Outcomes:

Upon completion of the course, the student will be able to:

1. Describe the concepts of zones of protection and different types of relays.
2. Illustrate the principles and recommend the usage of various circuit breakers used in power system network.
3. Investigate the protection schemes of equipment in power system network.
4. Evaluate the importance of using static relays and their schemes.

Course Content:

UNIT – I **[Text Book- 1] 15**

Protective Relays: Introduction - basic requirement of protective relaying - zones of protection – primary and backup protection - classification of relays - attracted armature, balanced beam, induction disc, thermal relays.

Buchholz's relay. Over current relays –inverse, very inverse, extremely inverse and IDMT relays, plug setting and time setting multipliers-problems- under voltage relays. directional and non- directional relays. negative sequence relays.

Distance relays – impedance, reactance, mho and off set mho relays. Characteristics of distance relays and comparison differential relays - circulating current and opposite voltage differential scheme.

UNIT – II **[Text Book- 1&2] 15**

Switchgear: Elementary principles of arc phenomenon - arc quenching - interruption of capacitive currents and low current chopping - resistance switching - recovery and restriking voltages.

Principles of operations of various types of circuit breakers - air break – oil filled - air blast -vacuum and SF6 circuit breakers.

Rating of circuit breaker and specifications of circuit breaker- numerical problems, testing of circuit breakers.

UNIT – III **[Text Book- 1 &2] 15**

Protection of alternators, transformers and transmission lines: Differential protection for generators, transformers and transmission lines - field suppression of alternator - over current and distance protection for feeders - Translay relay.

Grounding: Neutral grounding - solid grounding - resistance and reactance grounding - Arc suppression coil. Power system earthing: Objectives – definitions - tolerable limits of body currents - soil resistivity and earth resistance.

UNIT – IV [Text Book- 1 & Reference Book – 1] 15

Static Relays: Introduction – basic component of static relays. Comparators – amplitude and phase comparators.

Static over current relays – instantaneous over current relay – inverse time over current relays – static differential relays.

Learning Resources:

TEXT BOOKS:

1. Power System Protection and Switchgear by B.Ram – Tata Mc-Graw Hill 2001
2. Electrical power systems by C.L. Wadhwa, New age International (P) Limited

REFERENCE BOOKS:

1. Power system protection Static relays by T.S. MadhavaRao TMH 2nd edition 1981
2. The Art and Science of protective relaying by Mason Wiley Eastern Ltd
3. Power system protection and switchgear by B. Ravindranath, Chander Willy Eastern Ltd 1992
4. Fundamentals of Power System Protection by Y.G. Paithankar&S.R.Bhide, PHI, 2003
5. Switchgear and protection by Sunil S. RaoKhanna Publications

Web References:

1. https://nptel.ac.in/courses/108/101/108101039/
2. www.electrical4u.com
3. www.cdeep.iitb.ac.in/nptel/Electrical%20Engineering/Power%20System%20Protection/
4. http://www.electrical-installation.org/
5. http://electrical-engineering-portal.com/introduction-to-static-protection-relays
6. https://www.electrical4u.com/generator-protection/

EEEL 04 :: Power system operation & control

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To make the student to understand economic load dispatch under various operational constraints and techniques to solve the problem.
2. To know the importance of quality of power, P-f, Q-V control loops, AGC.
3. To discuss the concept of reactive power and voltage control in detail.
4. To understand the importance of reactive power control in power system.
5. To understand the importance of computer applications in power system and how load particulars are with the increase in load demand.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Describe the importance of economic operation of power systems.
2. Illustrate the operation of single area and two area AGC.
3. Design various voltage control mechanisms in distribution systems.
4. Control the voltage and reactive power in practical operating conditions.
5. Solve the Power management problems in industries and utilities with the help of latest equipment.

COURSE CONTENT:

Unit - I [Text Book- 1] (12)

Economic operation of power systems: Economic dispatch in thermal power station: Heat rate curves - cost curves - incremental fuel and production costs - economic distribution of load between units without consideration to line losses.

Transmission line losses as a function of plant generation - calculation of loss coefficients - optimum generation allocation between thermal plants.

Unit - II [Text Book- 1] (12)

Load frequency control: Importance of keeping voltage and frequency constant in a power system - Load frequency control (LFC) single area case - P-F loop: Schematic diagram of load frequency and excitation voltage regulators of a turbo-generator - mathematical modeling of generator, loads, prime mover and speed governor for LFC & corresponding block diagram representation - LFC block diagram of an isolated power system - steady state analysis - dynamic response. LFC for two area systems.

Automatic generation control (AGC) scheme - AGC in a single area and two area systems - block diagram representation.

Unit - III [Text Book- 1] (12)

Reactive power and voltage control: Loadability of transmission lines - sources and sinks of reactive power.

Voltage control of distribution systems: Tap changing - booster transformers -synchronous phase modifiers - induction regulators and static capacitors.

Reactive power control in synchronous generators: The role of excitation system, exciter, generator and sensor models - simplified AVR block diagram - steady state response for a step change in terminal voltage.

UNIT–IV [Text Book – 1, 3] (12)

Reactive power compensation of loads: Shunt compensating devices

Transmission line compensation: Series compensation - shunt compensation. StaticVAR compensators - thyristor controlled reactors (TCR) - thyristor switched capacitors(TSC) - combined TCR and TSC - schematic of all three types - STATCOM and FACTS devices.

Power System Control Centers:
Aim of control centers, functions of control centers – Planning, Monitoring and Data acquisition and System control. Setup, locations, central & civil facilities. Facilities in control room. Communication-PLCC. Emergency control

LEARNING RESOURCES:

TEXT BOOKS:

1) Modern power system analysis by D.P.Kothari&I.J.Nagrath McGraw Hill
2) Power system analysis by H.Saadat , Tata McGraw Hill, 2003
3) Power System analysis operation and control by Abhijit Chakrabarti&SunitaHalder, PHI

REFERENCE BOOKS:

1) Power system analysis by John J.Grainer and WD Stevenson Jr.,TMH 2007
2) Power system operation and control by S.Sivanagaraju& G. Sreenivasan, Pearson 2010
3) Generation, distribution and utilization of Electrical Energy by CL Wadhwa, New Age Int. publications, revised 2/E

WEB RESOURCES:

1. www.learnerstv.com/Free-Engineering
2. www.engr.usask.ca/departments/ee
3. www.elearning.vtu.ac.in/Programme12/E-Notes/PSOC/MSR.pdf
4. www.freevideolectures.com/.../Power-Systems-Operation-and-Control
5. www.unr.edu/ebme/academics/courses
6. www.cdeep.iitb.ac.in/nptel/Electrical
7. www.cramster.com/answers
8. www.power.uwaterloo

EEEL 05 :: Utilization of Electrical Power

Semester VII [Fourth Year]

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To derive the heating and cooling curve and to study the various classes of duty and Selection of power rating.
2. To impart the knowledge on electric traction as it is one of the most important applications of Electrical Engineering.
3. To make students learn the various usage of electrical energy such as illumination, heating, welding etc.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Choose a right and efficient drive for a particular application
2. Describe the mechanics of train movement & Calculate Specific Energy Consumption for a given run and explain the control methods of traction motors
3. Identify the usage of various types of Heating and Welding systems based on the application
4. Design Illumination systems for various applications

COURSE CONTENT:

UNIT - I [Text Book-1] (12)

Selection of Drive:

Factors governing selection of electric motors, Nature of electric supply, Types of drives, Types of loads, Choice of drive. Motor Power Rating: Insulating materials, Temperature rise in electrical machines, Duty cycles, Rating of machines, Choice of rating of motors, Load equalization.

UNIT - II [Text Book-1] (12)

ELECTRIC TRACTION:

Train movement: Typical speed-time curves, Crest speed average speed and schedule speed, Factors affecting schedule speed, Simplified speed-time curves, Mechanics of train movement, Tractive effort for propulsion of train. *Energy consumption:* Power output from the driving axles, Energy output from the driving axles, Specific energy output using simplified speed-time curve, Factors affecting specific energy consumption, Dead weight accelerating weight and adhesive weight.

Control of traction motors: Starting and speed control of DC traction motors, plain rheostatic starting (notching), Series-parallel starting, Transition methods, Drum controller, Contactor type controller.

UNIT – III [Text Book-1] (12)

Electric Heating:

Modes of transfer of heat, Stefan's law, Electric arc furnaces, Resistance heating, Design of heating element, Induction heating, High frequency eddy current heating, Dielectric heating, Choice of frequency.

Electric Welding:

Resistance welding, Electric arc welding, Arc welding with DC and AC, Comparison between resistance and arc welding (Excluding electronic controls)

UNIT - IV [Text Book-1] (12)

Illumination:

Terms used in illumination, Laws of illumination, polar curves, Photometry, Integrating sphere, measurement of illumination, Sources of light, CFL's, LED Lighting, efficient lighting. Arc lamps, Incandescent lamps, Effect of voltage variation, Gaseous discharge lamps, Fluorescent lamps, Comparison between filament and fluorescent tubes, design of lighting schemes, Factory lighting, Methods of lighting calculations, Flood lighting, Street lighting.

Learning Resources:

Text Books:

1. J.B.Gupta, "Utilization of Electrical Power and Electric Traction",S.K.Kataria & sons publications, 9th edition
2. Sunil S Rao, "Utilization, generation & conservation of electrical energy", by Khanna publishers, first edition 2005.
3. G.C.Garg, utilization of electric power and electrric traction. Khanna publishers, 2004.

Reference Books:

1. CL Wadhwa, "Generation distribution and utilization of electrical energy", New Age 2005.
2. M.L.Soni, P.V.Gupta, U. S. Bhatnagar and A Chakraborti, "A Text Book on Power System Engineering",DhanpatRai& Co. Pvt. Ltd., 2001.
3. Openshaw Taylor, "Utilization Electric Power", Orient Longman, 1986.
4. Partab H, "Art and Science of Utilization of Electrical Energy", DhanpatRai and Sons, Second edition.
5. Energy Efficiency in Electrical Utilities, BEE guide book, 2010.

Web References:

1. http://nptel.iitm.ac.in/video.php?subjectId=108105060 (Unit-V)
2. http://www.nptel.ac.in/courses/108105061/Illumination%20%20Engineering/Lesson-20/pdf/L20(NKK)(IE)%20((EE)NPTEL).pdf
3. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/
4. www.bee-india.org
5. www.irfca.org (Unit-II)

EEEL 06 :: Advanced Electric Drives

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To know about different types of high-power semiconductor devices drives and applications in various industries.
2. To acquire the knowledge of different level VSI configurations and modulation schemes.
3. To control the speed of induction motor using above converters.

Course Outcomes:

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

1. Identify the commonly used high-power semiconductor devices and their switching characteristics.
2. Describe the PWM schemes for the two-level voltage source inverter.
3. Illustrate the configurations and modulation schemes for cascaded H-bridge (CHB) and NPC multilevel inverters.
4. Explain the behaviour of induction Motor drives using two and multilevel VSI.

COURSE CONTENT:

UNIT-I [Text-book1] (10)

High-Power Semiconductor Devices

Technical Requirements and Challenges: Line-Side Requirements, Motor-Side Challenges, Switching Device Constraints, Drive System Requirements, Converter Configurations, MV Industrial Drives.

Introduction, High-Power Switching Devices: Diodes, Silicon-Controlled Rectifier (SCR), Gate Turn-Off (GTO) Thyristor, Gate-Commutated Thyristor (GCT), Insulated Gate Bipolar Transistor (IGBT), Other Switching Devices, Operation of Series-Connected Devices: Main Causes of Voltage Unbalance, Voltage Equalization for GCTs, Voltage Equalization for IGBTs.

UNIT-II [Text-book1] (10)

Two-Level Voltage Source Inverter

Introduction, Sinusoidal PWM: Modulation Scheme, Harmonic Content, Over-modulation, Third Harmonic Injection PWM, Space Vector Modulation: Switching States, Space Vectors, Dwell Time Calculation, Modulation Index.

UNIT-III [Text-book1] (10)

Multi-Level Voltage Source Inverter

Cascaded H-Bridge Multilevel Inverters

Introduction, H-Bridge Inverter: Bipolar Pulse-Width Modulation, Unipolar Pulse-Width Modulation, Multilevel Inverter Topologies: CHB Inverter with Equal dc Voltage, H-Bridges with Unequal dc Voltages, Carrier Based PWM Schemes: Phase-Shifted Multicarrier Modulation, Level-Shifted Multicarrier Modulation, Comparison Between Phase- and Level-Shifted PWM Schemes.

Diode-Clamped Multilevel Inverters

Introduction, Three-Level Inverter: Converter Configuration, Switching State, Commutation, Neutral-Point Voltage Control: Causes of Neutral-Point Voltage Deviation.

UNIT-IV [Text-book1] (10)

Voltage Source Inverter-Fed Drives

Introduction, Two-Level VBSI-Based MV Drives: Power Converter Building Block, Two-Level VSI with Passive Front End, Neutral-Point Clamped (NPC) Inverter-Fed Drives: GCT-Based NPC Inverter Drives, IGBT-Based NPC Inverter Drives, Multilevel Cascaded H-Bridge (CHB) Inverter-Fed Drives: CHB Inverter-Fed Drives for 2300-V/4160-V Motors, NPC/H-Bridge Inverter-Fed Drives

Learning Resources:

Text Books:

1. High-power Converters and AC Drives: Bin-Wu, IEEE Press, John Wiley & Sons.
2. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.

Reference Books:

1. Electric Motor Drives: Modeling, Analysis and Control – R. Krishnan – Prentice Hall
2. Vector Control of Electric Drives: Peter Vas, Oxford Publishers

EEEL 07 :: Electrical Distribution systems

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide sufficient theoretical and analytical background to understand the concepts of electric distribution system at various voltage levels.
2. To make the student to learn the distribution system
3. planning, automation, design of sub transmission lines
4. and distribution substation.
5. To develop skills for applying them in future on various engineering applications
6. To teach the analysis and design of primary and secondary systems.
7. To give an idea on calculation of voltage drops, power losses.

Course Outcomes:

Upon the completion of course, the student will be able to

1. Explain the concepts of distribution system Planning automation.
2. Design simple distribution system, sub transmission lines, primary feeder and Secondary feeders.
3. Categorize the design consideration of primary and secondary distribution systems
4. Identify equipment to be used for distribution system protection
5. Solve Distribution system compensation and voltage regulation problems.

COURSE CONTENT:

UNIT – I **[Text Book – 1] [15]**

Distribution systems planning and automation: Planning and forecast techniques - Present and future role of computers in distribution system planning –automation - Methods of improvement - Load characteristics – Definitions load growth – tariffs.

UNIT – II **[Text Book – 1] [15]**

Distribution transformers: Types - Regulation and Efficiency - Use of monograms for obtaining efficiency - distribution factors – KW KVA Method of determining regulation.

Deign of sub transmission lines and distribution substations: Introduction – sub transmission systems - distribution substation – Substation bus schemes - description and comparison of switching schemes – substation location and rating - Application of network flow techniques in rural distribution networks to determine optimum location of sub-station.

UNIT – III **[Text Book – 1] [15]**

Design considerations on primary systems: Introduction - types of feeders - voltage levels - Radial type feeders - feeders with uniformly distributed load and non-uniformly distributed loads.

Design considerations of secondary systems: Introduction - secondary voltage levels - Secondary banking - existing systems improvement.

Distribution system Protection: Basic definitions - over current protection devices - fuses, automatic circuit reclosures, automatic line sectionalizers - objectives of distribution system protection - coordination of protective devices - Fuse to Fuse co-ordination, Fuse to circuit breaker coordination, Reclosure to circuit breaker co-ordination.

UNIT-IV **[Text Book – 1] [15]**

Voltage drop and power loss calculations: Three phase primary lines - non 3 phase primary lines - 4 wire multi grounded primary lines - copper loss - Distribution feeder costs - loss reduction and voltage improvement in rural distribution networks.

Applications of Capacitors to distribution systems: Effect of series and shunt capacitors - Power factor correction - economic justification for capacitors - a computerized method to determine the economic power factor - Procedure to determine the best and optimum capacitor location

Distribution System Voltage Regulation: Basic definitions - Quality of service - voltage control - line drop compensation.

LEARNING RESOURCES:

TEXT BOOKS:

1. Electric Power Distribution System Engineering. By Turan Gonen, MGH
2. Electrical Distribution Systems by Dr. V. Kamaraju, Right Publishers
3. Electrical Power Distribution Automation by Sivanagaraju & Sankar, Dhanpatrai & Sons

REFERENCE BOOK:

1. Electric Power Distribution by A.S. Pabla, TMH, 4th Ed., 1997

Web Resources:

1. http://en.wikipediic.org/wiki/Electric-power-distribution
2. http://all-shares.com/download/g529889 Electric-power-distribution –systems.pdf.html
3. http://electricalengineeringtour.blogspot.com/2011/o1/free-download electric-distribution .html

EEEL 08 :: Wind and Solar Energy Systems

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To know wind and solar energy sources to meet the energy requirements.
2. To make the student to understand wind and solar power generation in detail.
3. To know various factors associated with wind and solar power generation.

Course Outcomes:

After successful completion of the course, the students are able to

1. Discuss about the energy scenario and the consequent growth of the power generation from renewable energy sources.
2. Restate the basic physics of wind and solar power generation.
3. Describe the details of power electronic interfaces for wind and solar generation.
4. Investigate the issues related to the grid-integration of solar and wind energy systems.

COURSE CONTENT:

Unit-1

Introduction to Wind Power

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

Unit-2

Topologies of Wind Generators

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent- Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Unit-3

Solar Photovoltaic System

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, Solar day length, Estimation of solar energy availability. Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms, Converter Control.

Unit-4

Network Integration & Solar power generation

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Learning resources:

Text books:

1. T. Ackermann, "Wind Power in Power Systems" , John Wiley and Sons Ltd., 2005.
2. H. Siegfried and R. Waddington, " Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.
3. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
4. J. A. Duffie and W. A. Beckman, " Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.

Reference books:

1. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
2. G. N. Tiwari and M. K. Ghosal, " Renewable Energy Applications" , Narosa Publications, 2004.

Web Resources:

1. https://www.elprocus.com › solar-energy-system
2. www.greenrhinoenergy.com

EEEL 09 :: Electrical Machine Design

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To get the knowledge of Principles of design of static and rotating machines.
2. To design main dimensions & cooling systems of transformers.
3. To design main dimensions of rotating machines.

Course Outcomes: After completion of the course the student will be able to

1. Describe the basic concepts of Electrical Machine Design
2. Design of main dimensions of transformer, cooling systems
3. Design of main dimensions of DC machine & field circuit.
4. Design of main dimensions of Induction motor & rotor.
5. Design of main dimensions of Synchronous Machine & field circuit.
6. Illustrate the principles of computerized design of machines limited to above background;

Course Content:

UNIT-I **[Text Book – 1] [15]**

D.C.Machines: E.M.F generated from full pitch - fractional pitch with and without distributed windings - distribution factor. Design of main dimensions from output equation - Design of Armature windings - Design of field system - Design of inter pole and commutator.

UNIT-II **[Text Book – 1] [15]**

Transformers: Derivation of output equation - volt per turn importance and calculation of main dimensions for three phase and single phase transformers - window dimensions - Yoke design and coil design - Design of tank with tubes.

UNIT-III **[Text Book – 1] [17]**

Induction Motor: Derivation of output equation - calculation of main dimensions – Stator design - number of slots - shape and area of slots - Rotor design for squirrel cage and slip ring types.

UNIT-IV **[Text Book – 1] [13]**

Synchronous Machines: Derivation of output equation - Calculations of Main Dimensions for salient pole and cylindrical rotor alternators - Stator design - number of stator slots and slot dimensions - Pole design for salient pole generators - pole winding calculations. Design of rotor for cylindrical rotor alternator - Design of rotor windings.

Computer Aided Design: Advantage of computer aided design - Flow chart for computer aided design.

Learning Resources:

Text Books:

1. A Course in Electrical machine Design by A.K. Sawhney, Dhanpatrai& Sons,
2. Performance and Design of AC Machines by M.G. Say CBS

REFERENCE BOOKS:

1. CEDT Manual on design and technology on low power transformers and inductors by IISC, Bangalore.
2. Design of Electrical Machines by V.N.MittleStandard Publishers Distributors 2009
3. Performance and Design of AC Machines by A.E. Clayton
4. Principles Of Electrical Machine Design by R.K. Agarwal, S.K. Kataria&Sons,2010
5.Computer aided design of electrical equipment by M. Ramamoothy Affiliated East West press Pvt Ltd New Delhi

Web References:

1. http://www.faadooengineers.com/threads/9454-Electrical-Machine-Design-full-notes-e-books-pdf-all-units
2. http://nptel.iitm.ac.in

EEEL 10 :: HVDC Transmission Systems

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To realize the basic concepts of HVDC links, converters and their control.
2. To give an idea about converter faults and protection schemes.
3. To design filter circuits to suit with HVDC systems.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Describe the importance of HVDC Links and converters
2. Analyze converter configurations used in HVDC transmission and list the performance metrics
3. Explain the details of converters and HVDC system control mechanisms
4. Identify converter faults and design protection schemes
5. Illustrate the existence of harmonics in HVDC system and design filter circuits

COURSE CONTENT:

Unit –I: [Text Book-1] (15)

DC POWER TRANSMISSION TECHNOLOGY

Introduction –Comparison of Ac and DC Transmission: Economics of power transmission, Technical performance, Reliability-application of DC Transmission.

Description of DC Transmission: Types of DC links, Converter station-Planning for HVDC Transmission-Modern trends in HVDC Technology-Some operating problems-HVDC Transmission based on Voltage Source Converters

Unit- II: [Text Book 2] (15)

ANALYSIS OF CONVERTER CIRCUITS &HVDC CONVERTERS

Converter circuits: Properties of converter circuits-Assumptions-single phase converters-three phase converters-pulse number-additional six-pulse converter circuits-choice of best circuit for HVDC converters-Twelve pulse cascade of two bridges.

Analysis of the HVDC converters: Analysis with Grid control but no overlap-Analysis of Grid control and with overlap less than 60^0-Analysis of Grid control and with overlap greater than 60^0 –Complete characteristics of Rectifier–Inversion.

Unit-III: [Text Book1] (15)

CONVERTER AND HVDC SYSTEM CONTROL

Principles of DC link control -converter control characteristics: Basic characteristics, modification of the control characteristics-system control hierarchy-Firing angle control: Individual Phase control-Equidistant pulse control- current and extinction angle control. Starting and stopping of DC link: Energization and de-energization of a bridge - power control –reactive power control-sub synchronous Damping control.

Unit-IV: [Text Book1& 2] (15)

CONVERTER FAULTS AND PROTECTION

Introduction-Converter faults: Commutation failure-Arc through-Misfire-Bypass valves- short circuit on a Rectifier- Arc back currents. Disturbances on AC side, Disturbances on DC side, Protection against over currents, Protection against over voltages-Surge arresters.

HARMONICS AND FILTERS

Generation of harmonics - Characteristic and Uncharacteristic harmonics - adverse effects of harmonics - calculation of voltage and current harmonics. Design of AC Filters: criteria of design, types of filters-Passive AC filters-DC Filters: criteria of design, types of filters.

Learning Resources:

Text Books:

1. K.R. Padiyar, 'HVDC power transmissions systems: Technology and system interactions' New age International (P) Ltd,2nd edition, 2012.
2. E.W.Kimbark, 'Direct Current transmission', John Wiley,1971.

REFERENCE BOOKS:

1. HVDC Transmission: Power Conversion Applications in Power Systems, Chan-Ki Kim, Vijay K. Sood, et. al.2009,Wiley-IEEE Press.
2. S. Rao, 'EHVAC and HVDC transmission engineering and practice', Khanna Publishsers, 3rd edition.
3. Adamson and Hingorani, 'HVDC transmission' ,Garraway Ltd, 1960

WEB RESOURCES:

1. http://freevideolectures.com/Course/3076/High-Voltage-DC-Transmission#
2. http://onlinevideolecture.com/?course_id=509&lecture_no=21
3. http://www.classiclearn.com/electrical-engineering/high-voltage-dc-transmission-course-video_a0eb80888.html
4. http://management.ind.in/forum/hvdc-nptel-142509.html

EEEL 11 :: Power Quality

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To understand the various Power quality problems
2. To become familiar with Power Quality considerations in Industry.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

1. Illustrate the importance the severity of power quality problems in power system.
2. Identify different types interruptions, origin of interruptions, predictions and precautions.
3. Analyze voltage sag problems and suggest preventive techniques.
4. Explain Power Quality considerations in Industrial Power Systems.

COURSE CONTENT:

UNIT-I [Text book-2]

INTRODUCTION: Introduction of the Power Quality (PQ) problem, General Classes of Power Quality Problems, Transients, Long-Duration Voltage Variations, Short-Duration Voltage Variations, Voltage Imbalance, Waveform Distortion, Voltage Fluctuation, Power Frequency Variations, Power Quality Terms.

UNIT-II [Text book-1]

LONG INTERRUPTIONS: Interruptions – Definition –causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption.

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, mitigation methods of interruptions.

UNIT III [Text book-1]

VOLTAGE SAG CHARACTERIZATION: 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 unbalance, phase angle jumps, load influence on voltage sags, mitigation methods of voltage sag.

UNIT-IV [Text book-1]

POWER QUALITY CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS: 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.

Learning Resources:

Text Books:

1. Understanding Power Quality Problems by Math H J Bollen. IEEE Press.
2. Electrical Power Systems Quality: Roger C. Dugan, MF McGranaghan, Surya Santoso and HW Beaty, TMH, 2/E

Reference Books:

1. Power Quality: Problems and Mitigation Techniques Bhim Singh et. al. John Wiley & Sons, 16-Feb-2015
2. Handbook of power quality by Angelo Baggini , John Wiley 2008.
3. Power Quality by C. Sankaran - CRC PRESS.
4. Power System Harmonics, Jos Arrillaga, Neville R. Watson, John Wiley & Sons, 2003.
5. Power Quality VAR Compensation in Power Systems, R. SastryVedam Mulukutla S. Sarma, CRC Press.
6. G.T.Heydt, "Electric Power Quality", Stars in a Circle Publications, 1994(2nd edition).
7. Angelo Baggini 'Handbook of Power Quality' – Wiley.

EEEL 12 :: Flexible AC Transmission Systems

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To understand the need for reactive power compensation and system stability in AC transmission system.
2. To become familiar with operation of various FACTS controllers and their impact on AC transmission system.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Describe the importance of FACTS controllers in transmission system to enhance the system performance, control strategies for different types of converters for static compensation.
2. List different types of shunt compensators and their objectives, types and will be able to compare transient and dynamic stability performance of different controllers.
3. Describe the objectives of series compensators and importance of static voltage and phase angle regulators towards active, reactive power flow control.
4. Explain the concepts of UPFC and IPFC, control strategies for controlling P and Q.

COURSE CONTENT:

UNIT-I [Text Book- 1] (12)

FACTS Concept and General system Considerations:

Flow of power in an AC System-power flow and Dynamic stability Considerations of a Transmission Interconnection-Relative importance of Controllable Parameters-Basic Types of FACTS Controllers.

Converters for Static Compensation - Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM) - GTO Inverters - Multi-Pulse Converters and Interface Magnetics-Transformer Connections for 6 and 12 pulse operation.

UNIT-II [Text Book- 1&2] (12)

Static Shunt Compensators: SVC and STATCOM - Operation and Control of TSC, TCR, STATCOM - Comparison between SVC and STATCOM - STATCOM for transient and dynamic stability enhancement.

UNIT-III [Text Book-1] (12)

Static Series Compensation: GCSC, TSSC, TCSC and SSSC -Operation and Control - External System Control for series Compensators - SSR and its damping - Static Voltage and Phase Angle Regulators - TCVR and TCPAR - Operation and Control.

UNIT-IV [Text Book-1] (12)

UPFC and IPFC: The unified Power Flow Controller - Operation - Comparison with other FACTS devices - control of P and Q – Dynamic Performance - Special Purpose FACTS controllers - Interline Power flow Controller - Operation and Control.

LEARINING RESOURCES:

TEXTBOOKS:

1. Hingorani N. G. and Gyugyi L., 'Understanding FACTS', IEEE Press, Standard Publishers Distributors, 2001.
2. Mohan Mathur.R., Rajiv. K.Varma, 'Thyristor – Based Facts Controllers for Electrical Transmission Systems', IEEE press and John Wiley & Sons, 2000.

REFERENCE BOOKS:

1. PadiyarKR, 'FACTS Controllers in power transmission and distribution', New Age International Publications, 2001.
2. M.H. Rashid, 'Power Electronics, circuits, devices and applications' Pearson 3rd edition, 2005.
3. Miller T. J. E., 'Reactive Power Control in Electric Systems,' Wiley-Interscience, 1982.

WEB REFERENCES:

1. http://www.eetindia.co.in/VIDEO_DETAILS_700001240.html
2.http://nptel.iitm.ac.in
3.www.ece.unb.ca/sharaf/downloads/ppt/ppt_046.ppt

EEEL 13 :: High Voltage Engineering

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To gain fair knowledge about break down mechanism in gases.
2. To provide sufficient theoretical and analytical background to understand the concepts of Generation of High DC,AC and impulse voltages.
3. To gain the knowledge on how the generated high voltages and currents are measured by using different measurement techniques and know testing methods of various high voltage electrical apparatus.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Describe the concepts of break down mechanism in gases and generation of high DC voltages.
2. Illustrate generating methods of high AC, Impulse voltages and currents.
3. Assess various methods to measure different high voltages and currents in high voltage laboratory and in the field.
4. Outline the details of various methods of testing different high voltage equipment that are used in power system network.

COURSE CONTENT:

UNIT-I **[Text Book-2] (12)**

Break down mechanism in gases Gases as insulating media –ionization processes-Townsend's current growth equation-Towsend's criterion for break down-experimental determination of coefficients α and γ. Break down in electro negative gases-time lags for breakdown-Stramer theory of break down in gases-Paschen's law-break down in non-uniform fields and corona discharges.

Generation of High D.C Voltages: principle of voltage doubler circuit – voltage multiplier circuits Cockcroft-Walton cascade arrangement and its mathematical analysis– Van de Graff generators- regulation of d.c voltages.

UNIT-II **[Text Book-1&2] (12)**

Generation of High A.C Voltages cascade connection of transformers - resonant transformers- Tesla coil-numerical problems.

Generation of Impulse Voltages: Standard specifications - standard wave shapes for testing - properties of double exponential wave shapes - approximate estimate of wave shape control resistors - Multistage impulse generator - Energy of impulse generator.

Generation of Impulse Currents: Standard specifications - analysis of impulse current generator-Generation of Rectangular current Pulses-Tripping and control of impulse Generators.

UNIT-III **[Text Book-2] (12)**

Measurement of High DC,AC Voltages and Impulse voltages: General concepts of High voltage measurements – series ammeter-potential dividers and generating voltmeters for the measurement of DC voltages.

Resistive, Inductive and Capacitive voltage dividers for high AC voltage and impulse voltage measurement. Use of fibre optic for the measurement of AC current-various shunts used for measuring DC current, and impulse currents.

UNIT-IV **[Text Book-1&2] (12)**

Measurement of DC resistivity, measurement of dielectric constant and loss factor

High Voltage Testing Techniques: Testing of insulators – Bushings - isolators and CB's - Testing of transformers, surge diverters and cables.

Learning Resources:

Text Books:

1. Kuffel, E, Zaengl W.S, Kuffel J- "High Voltage Engineering fundamentals" ,Published by A.Wheaton &

CO Ltd.2nd edition,2000.
2. M.S. Naidu &V. Kamaraju- "High Voltage Engineering", Tata McGraw-Hill Education Pvt. Ltd,5th edition,2013.

Reference Books:

1. CL Wadhwa-"High voltage engineering",New age International,Third edition,2010.
2. Ravindra Arora & Wolfgang Mosch ,"High Voltage Insulation Engineering", New Age International (P) Limited, 1st Edition, 1995.
3. Rakesh Das Begamudre-"Extra High Voltage AC transmission Engineering"New Age International, 4th Edition (reprint)– 2011.
4. Adolf J.Schwab-."High Voltage measurement techniques",M.I.TPress Cambridge, Massachusetts,1972.

Web references:

1. http://www.generalcable-fr.com/Portals/france/pdf/en/2101_HVleaflet.pdf
2.http://www.energy.siemens.com/hq/pool/hq/energytopics/power%20engineering%20guide/PEG_70_KAP_03.pdf
3. http://www.elect.mrt.ac.lk/pdf_notes.htm
4. http://nptel.ac.in/courses/108104048/ui/TOC.htm
5. https://lecturenotes.in/subject/180/high-voltage-engineering-hve

EEEL 14 :: Electrical Energy Conservation and Auditing

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To facilitate the students with the knowledge on energy audit of industries, buildings and organisation of energy management with proper controllers.
2. To enable the students to have a fair knowledge about power factor improvement methods and economical aspects of the industrial electrical equipment.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. List various methods of energy auditing of industries, buildings along with the conservation schemes.
2. Describe the detailed energy management schemes and controlling methods.
3. Examine the conservation concepts of variable speed, variable duty cycle systems and unbalanced voltage systems with compensating methods.
4. Illustrate the operation of energy instruments, economic analysis and aspects of the apparatus with different techniques.

COURSE CONTENT:

UNIT-I: [Text Book1] (15)

BASIC PRINCIPLES OF ENERGY AUDIT

Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes-

Energy audit of industries-energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT-II: [Text Book1] (15)

ENERGY MANAGEMENT Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting

Energy manger, Qualities and functions, language, Questionnaire – check list for top management.

UNIT-III: [Text Book1] (15)

ENERGY EFFICIENT MOTORS Energy efficient motors , factors affecting efficiency, loss distribution , constructional details ,characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit

POWER FACTOR IMPROVEMENT,

Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on power factor, power factor motor controllers

UNIT-IV: [Text Book1] (15)

LIGHTING AND ENERGY INSTRUMENTS

Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments-wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC's.

ECONOMIC ASPECTS AND ANALYSIS Economics Analysis-Depreciation Methods, time value of money, rate of return , present worthmethod , replacement analysis, life cycle costing analysis

Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting -Applications of life cycle costing analysis, return on investment.

Learning Resources:

Text Books:

1. W.R. Murphy and G. Mckay Butter worth, Energy management,Heinemann publications.
2. Paul o' Callaghan, Energy management, Mc-graw Hill Book company-1st edition, 1998

Reference Books:

1. John .C. Andreas, Marcel Dekker, Energy efficient electric motors,Inc Ltd-2nd edition, 1995-
2. W.C.Turner, Energy management hand book, John wiley and sons
3. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

Web Resources:

1. http://www.enernoc.com/our-resources/term-pages/what-is-an-energy-audit
2. http://energy.gov/energysaver/professional-home-energy-audits
3. http://www.cpri.in/about-us/departmentsunits/energy-efficiency-and-renewable-energy-division-ered/energy-audit-services.

EEEL 15 :: Power System Dynamics and Control

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To remember the dynamic characteristics of power system equipment,
2. To recognize dynamic performance of power systems.
3. To model different power system components for the study of stability.
4. To illustrate the system stability

Course Outcomes: Upon the completion of the subject, the student will be able to

1. Choose the fundamental dynamic behavior and controls of power systems to perform basic stability analysis.
2. Comprehend concepts in modeling and simulating the dynamic phenomena of power systems Interpret results of system stability studies.
3. Analyze theory and practice of modeling main power system components, such as synchronous machines, excitation systems and governors
4. Illustrate Small signal analysis for the study of system stability.

COURSE CONTENT:

UNIT- I

Basic Concepts: Power system stability states of operation and system security – system dynamics – problems system model analysis of steady State stability and transient stability – simplified representation of Excitation control.

UNIT- II

Modeling of Synchronous Machine: Synchronous machine – park's Transformation-analysis of steady state performance per – unit quantities-Equivalent circuits of synchronous machine determination of parameters of equivalent circuits.

UNIT- III

Excitation System: Excitation system modeling-excitation systems block Diagram – system representation by state equations- Dynamics of a synchronous generator connected to infinite bus – system model Synchronous machine model-stator equations rotor equations – Synchronous machine model with field circuit – one equivalent damper winding on q axis – calculation of Initial conditions.

UNIT- IV

Analysis of Single Machine System: Small signal analysis with block diagram – Representation Characteristic equation and application of Routh Hurwitz criterion- synchronizing and damping torque analysis-small signal model – State equations.

Learning Resources:

Text Books:

1. K. R. PADIYAR," Power system dynamics, stability and control "- B.S. Publications.
2. P.M. Anderson and A. A. Fouad, "Power system control and stability", IEEE Press

Reference Books:

1. R. Ramanujam, "Power Systems Dynamics"- PHI Publications.

EEEL 16 :: Line-Commutated and Active PWM Rectifiers

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide sufficient knowledge on power electronic converters
2. To provide sufficient knowledge on modulation techniques of converters and multi-level inverters

Course Outcomes:

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

1. Explain the details of controlled rectifier circuits.
2. Describe the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
3. Illustrate the principles of operation of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

Course Content:

Unit-1 **[10]**

Thyristor rectifiers with passive filtering

Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current wave shape.

Unit-2 **[10]**

Multi-Pulse converter

Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6- pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

Unit-3 **[10]**

Single-phase ac-dc single-switch boost converter

Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed-loop control structure.

Unit-4 **[10]**

Ac-dc bidirectional boost converter & Isolated 1-ϕ ac-dc fly back converter

Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Dc-dc fly back converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc fly back converter, steady state analysis, unity power factor operation.

Learning Resources:

Text Books:

1. Principles of Thyristorised Converters - G. De-Oxford & IBH Publishing Co -1988-First edition.
2. Principles of Power Electronics -J.G. Kassakian,M. F. Schlecht and G. C. Verghese-Addison-Wesley,1991-Second edition.

Reference Books:

1. Power Electronics: Essentials and Applications- L-. Umanand -Wiley India, 2009-First edition.
2.Power Electronics: Converters, Applications and Design- N. Mohan and T. M. Undeland -John Wiley &Sons, 2007-Second edition.
3.Fundamentals of Power Electronics-. R. W. Erickson and D. Maksimovic -Springer Science & Business Media, 2001

EEEL 17 :: Industrial Electrical Systems

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To equip with the skills and knowledge on various industrial electrical systems
2. To successfully carry out basic service and maintenance of Industrial Electrical Systems in a safe and environmentally sound manner.

Course Outcomes:

After successful completion of the course, the students are able to

1. Explain the details of various components of industrial electrical systems
2. Design the electrical wiring systems for residential & commercial applications and their Illumination systems.
3. Analyze and select proper size of various electrical system components.
4. Illustrate the concepts of various industrial electrical systems automation.

COURSE CONTENT:

Unit-1

Electrical System Components

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Unit-2

Residential and Commercial Electrical & Illumination Systems

Types of residential and commercial wiring systems, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation.

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems.

Unit-3

Industrial Electrical Systems

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit-4

Industrial Electrical System Automation

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Learning resources:

Text books:

1. Industrial Electrical Systems – I, Dr. Deepak S. Bankar, Edition – 2018.
2. S. L. Uppal and G. C. Garg, " Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.

Reference books:

1. Residential, Commercial and Industrial Electrical Systems, Hemant Joshi, TMH-2008

2. Industrial Safety, Health and Environment Management Systems, R. K. Jain, Sunil S. Rao, Khanna Publications – 2000.
3. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
4. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.

Web Resources:

1. *https://www.essltd.ie*
2. *https://www.accessengineeringlibrary.com*
3. *www.intermountainelectronics.com*

EEEL 18 :: Smart Electric grids

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide the students a systems perspective of modern electricity markets and a systems approach to address various issues faced by the electricity sector.
2. To provide the students an in-depth knowledge of how electricity markets operate from short-term system dispatch to long-term asset investments.
3. To present the student a vision of how Smart Grid will transform the current electricity grid to a reliable and sustainable modern energy system.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Discuss the structure of an electricity market in either regulated or deregulated market conditions.
2. Enumerate the detailed pricing of electricity (wholesale) in a transmission network.
3. Evaluate the trade-off between economics and reliability of an electric power system.
4. Illustrate the impacts of renewable resources to the grid and the various issues associated with integrating such resources to the grid.

COURSE CONTENT:

UNIT–I **[Text Book 1] 12**

INTRODUCTION: Introduction to smart grid- Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.

SMART GRID TO EVOLVE A PERFECT POWER SYSTEM: Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power Systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

DC DISTRIBUTION AND SMART GRID: AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.

UNIT–II **[Text Book 1] 12**

INTELLIGRID ARCHITECTURE FOR THE SMARTGRID: Introduction- Launching intelligrid-Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies.

DYNAMIC ENERGY SYSTEMS CONCEPT: Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems- Integrated communications architecture-Energy management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

UNIT–III **[Text Book 1] 12**

ENERGY PORT AS PART OF THE SMART GRID: Concept of energy -Port, generic features of the energy port.

POLICIES AND PROGRAMS TO ENCOURAGE END – USE ENERGY EFFICIENCY: Policies and programs in action -multinational - national-state-city and corporate levels.

MARKET IMPLEMENTATION: Framework-factors influencing customer acceptance and response - program planning-monitoring and evaluation.

UNIT–IV: **[Text Book 1] 12**

EFFICIENT ELECTRIC END – USE TECHNOLOGY ALTERNATIVES: Existing technologies – lighting - Space conditioning - Indoor air quality - Domestic water heating- hyper efficient appliances - Ductless residential heat pumps and air conditioners – Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances –

Data center energy efficiency- LED street and area lighting - Industrial motors and drives -Equipment retrofit and replacement - Process heating - Cogeneration, Thermal energy storage -Industrial energy management programs - Manufacturing process-Electro-technologies,
Residential, Commercial and industrial sectors.

LEARNING RESOURCES:

TEXT BOOKS:

1. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response" - CRC Press, 2009.
2. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong.Wu, AkihikoYokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.
3. James Momoh, "Smart Grid :Fundamentals of Design and Analysis"-Wiley, IEEE Press,2012.

REFERENCE BOOKS:

1. Yang Xiao, "Communication and Networking in Smart Grids", CRC Press
2. Jean Claude Sabonnadière, NouredineHadjsaïd, "Smart Grids", Wiley Blackwell
3. Peter S. Fox Penner, "Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities", Island Press; 1 edition 8 Jun 2010
4. Stuart Borlase, "Smart Grids (Power Engineering)", CRC Press

WEB RESOURCES:

1. http://smartgrid.ieee.org/
2. http://www.nptel.ac.in/courses/108108078/pdf/chap10/teach_slides10.pdf
3. http://www.iitk.ac.in/ime/anoops/for15/ppts/

EEEL 19 :: Digital Control Systems

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To understand the concepts of digital control systems and assemble various components associated with it.
2. The theory of z–transformations and application for the mathematical analysis of digital control systems.
3. To represent the discrete–time systems in state–space model and evaluation of state transition matrix.
4. To examine the stability of the system using different tests and study the design of state feedback control by "the pole placement method."

Course outcomes:

Upon successful completion of the course, the student will be able to

1. Learn the advantages of discrete time control systems and the "know how" of various associated accessories.
2. Use z–transformations in the mathematical analysis of different systems (like Laplace transforms in analog systems).
3. Describe stability criterion for digital systems and methods adopted for testing the same
4. Design the system based on conventional and state space methods.

Course Content:

UNIT – I: [Text book-1] (15)

Signal processing and z–transformations

Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Signals and processing – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.

UNIT – II: [Text book-1] (15)

Stability analysis

Mapping between the s–Plane and the z–Plane – Primary strips and Complementary strips – Stability criterion – Modified Routh's stability criterion and Jury's stability test.

UNIT-III: [Text book-1] (15)

Design of discrete–time control systems by conventional methods

Transient and steady state specifications – Design using frequency response in the w–plane for lag and lead compensators – Root locus technique in the z–plane.

UNIT–IV: [Text book-2] (15)

State space analysis and design

State space representation of discrete time systems – State transition matrix and methods of evaluation – Discretization of continuous – Time state equations – Concepts of controllability and observability – Tests(without proof). Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula.

Learning Resources:

Text Books:

1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd edition.
2. Digital Control and State Variable Methods by M.Gopal, TMH, 4th edition.

Reference Books:

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.

2. Digital Control Systems – by P.N. Paraskevopoulos, Prentice Hall, 1996.

EEEL 20 :: Control Systems Design

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

Main objectives of this course are

1. To design different control systems for different applications as per given specifications
2. To discuss basic aspects of design and compensation of linear control systems using Bode plots.
3. To analyse and design feedback control systems with P,PI,PID Controllers
4. To give an idea on state space analysis, and state feedback controllers design.

Course Outcomes

Upon completion of the course, student will be able to:

1. Design Lag, Lead, Lag-Lead compensators to improve system performance from Bode diagrams.
2. Plan the control systems for various applications that can be designed using time-domain and frequency domain analysis.
3. Design simple control systems and modify the parameters to meet specific requirements
4. Design feedback control systems and construct the state observers.

Course Content

UNIT – I [Text book-1] (15)

Compensators design

Introduction to design using compensators, Lag, Lead, Lag-Lead compensators, design of compensators – using Root locus and Bode plot.

UNIT–II [Text book-1] (15)

Controllers design

PI,PD and PID controllers design in both time domain and frequency domain.

UNIT – III [Text book-2] (15)

State Space Analysis of LTI Systems

Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- Solving the time invariant state equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

UNIT – IV [Text book-1] (15)

State feedback controllers Design: Feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

Learning Resources:

Text Books:

1. Goodwin, G.C. Graebe, S.F. and M.E. Salgado, "Control stem Design", Prentice Hall of India, 2001.

2. Modern Control Engineering by Ogata. K – Prentice Hall – 1997.

Reference Books:

1. Friedland, B "Advanced Control System Design", Prentice Hall Int., 1966.
2. Modern control systems, Richard C. Dorf and Robert H. Bishop, 11th Edition, Pearson Edu, India, 2009.

EEEL 21 :: Digital Signal Processing

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide sufficient theoretical, analytical background about digital signals and systems.
2. Make the student to learn about Z- transform& Fourier transformation.
3. To understand the differences between DFT & FFT Transforms.
4. Make the student to design analog and digital IIR filters & FIR filters.
5. To study the realization of digital filters.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Explain the details of discrete time signal processing and characterization of random signals, filter design techniques.
2. Calculate the discrete Fourier series, Fourier transform for discrete time systems and discrete Fourier transform using FFT algorithms.
3. Illustrate the theory of modern digital signal processing and digital filter design, including window's techniques involving digital filter design.
4. Illustrate and realize various digital filters.

COURSE CONTENT:

UNIT – I (TEXT BOOK-1 & REFERENCE BOOK-1) (15)

DISCRETE TIME SIGNALS AND SYSTEMS: Introduction to digital signal processing - Advantages and applications – Classification of signals-discrete time signals, representation. LTI system: Stability and causality.

Z-TRANSFORMS: Z-transforms - Region of convergence - Z-transform properties - Relation between Z-transform and Fourier transform of a sequence - Inverse Z transform using Partial fraction method, Cauchy's integration theorem - Solution of difference equations using one sided Z-transform.

UNIT – II (TEXT BOOK-1 & REFERENCE BOOK-1) (15)

DFS & DFT: Discrete Fourier Series - Properties of DFS - Discrete Fourier Transform - Properties of DFT - Linear convolution using DFT.

FFT: Computations for evaluating DFT - Decimation in time FFT algorithm - Decimation in frequency FFT algorithm - Computation of inverse DFT.

UNIT – III (TEXT BOOK-1 & REFERENCE BOOK-1) (15)

IIR FILTER DESIGN TECHNIQUES: Introduction - Properties of IIR filters - Design of Analog Butterworth and Chebyshev filters, Design of Digital Butterworth and Chebyshev filters using bilinear transformation - Impulse invariance transformation methods. Design of digital filters using frequency transformation method.

UNIT – IV (TEXT BOOK-1 & REFERENCE BOOK-1) (15)

FIR FILTER DESIGN TECHNIQUES: Introduction - Characteristics of linear phase FIR filters - Frequency response. Designing FIR filters using Fourier series method, windowing methods: Rectangular window - Bartlett triangular window - Hanning window - Hamming window - Blackman window - Comparison of IIR and FIR filters.

REALISATION OF DIGITAL FILTERS: IIR Filters: Direct – Canonic – Cascade – Parallel realizations. FIR Filters: Direct, Cascade and linear phase realizations.

Learning Resources:

TEXT BOOKS:

1. John G.Proakis, Dimitris G Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Pearson Education / PHI, 2015.
2. Tarun Kumar Rawat, "Digital Signal Processing", Oxford University Press, 2015.

REFERENCE BOOKS:

1. P. Ramesh Babu, "Digital Signal Processing", 6th Edition, Scitech Publications, 2015
2. Johnny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2009.

Web Resources:

1. https://nptel.ac.in/courses/117/102/117102060/
2. http://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/video-lectures/
3. http://freevideolectures.com/Course/2339/Digital-Signal-Processing-IITKharagpur#

EEEL 22 :: Computer Architecture

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To understand the basic organization of modern computer systems
2. To interpret how computer programs are organized, stored, and executed at the machine level.
3. To analyze an instruction-set architecture and propose a suitable datapath and control unit implementation.
4. To understand how instruction pipelining enhances processor performance.
5. To understand the input/output mechanisms used to connect computers to their external environments.
6. To learn the concepts of memory hierarchy and do operations with various types of memories.

Course Outcomes:

Upon completion of the course, the student will be able to

1. Analyze system performance at an overall level based on throughput and response time.
2. Attain capability to make computer architecture design decisions based on measures such as cycles-per-instruction and instructions-per-cycle.
3. Understand memory hierarchy both with respect to physical organization and virtual memory as provided in modern operating systems.
4. Use binary and hexadecimal number systems.
5. Implement fast integer multiplication methods such as Booth's algorithm.
6. Illustrate the concepts of floating point representation and arithmetic, including discussion of rounding and precision errors.
7. Design and implement single-cycle, multi-cycle, pipelined, and super-scalar architectures.

Course Content:

UNIT – I **[Text Book – 1]** **(13)**

Register Transfer And Microoperations: Register Transfer Language, Register Transfer, Bus and memory Transfers, Arithmetic Micro-operations, Logic Micro operations, Shift Micro operations, Arithmetic logic shift unit

Basic Computer Organisation And Design: Instruction codes, Computer Registers, Computer Instructions, Timing and control, Instruction cycle, Memory-Reference Instruction, Input-output and Interrupt, Design of basic computer, Design of accumulator logic.

UNIT – II **[Text Book – 1]** **(17)**

Micro Programmed Control: Control Memory, Address Sequencing, Micro program example, design of control unit.

Central Processing Unit : General register organization, stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, Reduced Instruction set computer (RISC).

Pipe Line And Vector Processing: Parallel processing, pipelining, Arithmetic pipeline, RISC pipeline, vector processing, Array Processing.

UNIT – III **[Text Book – 1]** **(15)**

Computer Arithmetic: Addition and Subtraction, multiplication Algorithms, Division Algorithms, Floating-point Arithmetic operations.

Input -Output Operations : Peripheral Devices, Input-output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor, Serial communication.

UNIT – IV **[Text Book – 1]** **(15)**

Memory Organisation: Memory hierarchy, Main memory, Auxiliary memory, Associate Memory, Virtual Memory, Memory management hardware.

Multiprocessors: Characteristics of multiprocessors, Interconnection Structures, InterprocessorArbitation, Interprocessor communication and synchronization, cache coherence.

TEXT BOOKS:

1. Computer systems Architecture - by Morris Mano (Chapters: 4,5,7 to 13) (3rd edition).

REFERENCE BOOKS:

1. Computer Architecture and organisation - by John P Hayes (2nd Ed.)
2. Computer Organization - by V. Carl Hamacher et.al. (2nd ed.)

Web References:

1.http://prezi.com/swvy4dq3jzyb/comorla-basic-structure-of-computer-hardware-and-software/ %Basic structure of computers

2.http://publib.boulder.ibm.com/infocenter/iseries/v5r3/index.jsp?topic=%2Fapis%2FMIintro.htm %Machine interface instructions

3.https://www.classle.net/large-content/hardwired-control-vs-microprogram %Hardwired Control Vs Microprogram

4. https://www.classle.net/node/23942 % Superscalar Operation

5. http://www.eecg.toronto.edu/~moshovos/ACA05/004-pipelining.pdf Overview of pipelining

EEEL 23 :: Electromagnetic Waves

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To Provide solution to real life plane wave problems for various boundary conditions.
2. To Analyse the field equations for the wave propagation in special cases such as lossy and low loss dielectric media.
3. To Analyse transmission lines and estimate voltage and current at any point on transmission line for different load conditions.
4. To Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide.

Course Outcomes:

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

1. Solve real life plane wave problems for various boundary conditions.
2. Analyse the field equations for the wave propagation in special cases such as lossy and low loss dielectric media.
3. Analyse transmission lines and estimate voltage and current at any point on transmission line for different load conditions.
4. Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide.

Course Content:

Unit I Maxwell's Equations (15 hours)

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Displacement Current Density, Maxwell's Equations in Different Final Forms, Conditions at a Boundary Surface: Dielectric – Dielectric.

Unit II: Plane Waves at media interface (15 hours)

Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

Unit III: Transmission Lines (15 hours)

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless transmission line, Distortion - Condition for Distortionlessness and Minimum Attenuation, Illustrative Problems.

Unit IV: Waveguides (15 hours)

Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, Rectangular waveguides.

Learning Resources:

Text Books:

1. R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill, 2005.
2. M. N.O. Sadiku, " Elements of Electromagnetics", Oxford University Press, 2007.

Reference Books:

1. D. K. Cheng, " Field and Wave Electromagnetics", Addison-Wesley, 1989.
2. C. A. Balanis, " Advanced Engineering Electromagnetics", John Wiley &Sons, 2012.

EEEL 24 :: Computational Electromagnetics

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

This course should enable the students to

1. Understand conventional design methodology to study electromagnetic fields.
2. Apply various methods to solve electromagnetic field related problems.
3. Use numerical methods to study accuracy and stability.
4. Discuss numerical methods for efficient finite element computation.

Course Outcomes:

At the end of this course, students will able to

1. Describe the design methodology to study electromagnetic fields.
2. Implement various methods to solve electromagnetic field related problems.
3. Apply numerical methods to study accuracy and stability.
4. Use numerical methods for efficient finite element computation.

Course Content:

UNIT I: INTRODUCTION TO COMPUTATIONAL METHODS 15Hours

Conventional design methodology, Computer aided design aspects, advantages. Review of basic fundamentals of electrostatics and electromagnetics, development of Helmhotz equation, energy transformer vectors- Poynting and Slepian, magnetic diffusion-transients and time-harmonic.

UNIT II: ANALYTICAL METHODS 15Hours

Analytical methods of solving field equations, method of separation of variables, Roth's method, integral methods- Green's function, method of images.

UNIT III: FINITE DIFFERENCE METHOD 15Hours

Finite difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions; Finite Difference Time-Domain (FDTD) method- Uniqueness and convergence.

UNIT IV: FINITE ELEMENT METHOD 15Hours

Overview of FEM, Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, efficient finite element computations.

Learning Resources:

Text Books:

1. Analytical and Computational Methods in Electromagnetics, By R.Garg, ArtechHousePublication
2. Computational Methods for Electromagnetics and Microwaves,By R.C Booton, Jr, , John Wiley & Sons
3. Computational Methods for Electromagnetics, By A. F. Peterson, S. L. Ray, and R. Mittra, IEEE Press

Reference Books

1. P. P. Silvester and R. L. Ferrari " Finite Element for Electrical Engineers" , Cambridge University press, 1996.
2. M. N. O. Sadiku, "Numerical Techniques in Electromagnetics", CRC press, 2001.

EEEL 25 :: Power System Deregulation

L	T	P	C	Int	Ext
3	-	-	3	40	60

Course Objectives:

1. To provide in-depth understanding of operation of deregulated electricity market systems.
2. To examine typical issues in electricity markets and how these are handled world-wide in various markets.
3. To enable students to analyze various types of electricity market operational and control issues using new mathematical models.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Illustrate the operation of deregulated electricity market systems
2. Explain different electricity market mechanisms
3. Address and review typical issues in electricity markets
4. Investigate electricity market operational and control issues using new mathematical models.

COURSE CONTENT:

UNIT I [Text Book-1](12)

DEREGULATION OF ELECTRIC UTILITIES: Introduction – Traditional central utility model, reform motivations, separation of ownership and operation

Competition and direct access in the electricity market, independent system operator (ISO), retail electric providers, different experiences.

UNIT II [Text Book-1] (12)

COMPETITIVE WHOLESALE ELECTRICITY MARKETS & TRANSMISSION OPEN ACCESS: Introduction, ISO, wholesale electricity market characteristics, market model, challenges, trading arrangements

The pool and bilateral trades, multi lateral trades.

TRANSMISSION COST ALLOCATION METHODS: Introduction - Postage Stamp Rate Method - Contract Path Method - MW-Mile Method

Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods.

UNIT III [Text Book-1] (12)

MARKET POWER: Introduction - Different types of market Power – Mitigation of Market Power – Examples

ANCILLARY SERVICES MANAGEMENT: Introduction – Reactive Power as an Ancillary Service – a Review – Synchronous Generators as Ancillary Service Providers.

UNIT IV [Text Book-1] (12)

AVAILABLE TRANSFER CAPABILITY (ATC): Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow

Introduction – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting.

Learning Resources:

Text Books:

1. Loi Lei Lai, Power System Restructuring and Deregulation, John Wiley & Sons Ltd., England, 2001.

Reference Books:

1. Kankar Bhattacharya, Operation of Restructured Power System, Math H.J. Boller and Jaap E.DaalderKulwer Academic Publishers, 2001.
2. Marcel Dekker, Restructured Electrical Power Systems, Inc., 2001.

Web Resources:

1. http://www.nptel.ac.in/courses/108101005/

EEV 01 English Competency Development Program

L	T	P	C	Int	Ext
2	0	0	-	100	-

LECTURE PLAN

Session Topic

1. Self Introduction
2. Self Introduction
3. Introducing Others
4. Mind Mapping -Small Talk
5. Random Operation
6. JAM & Extempores
7. Starting a Conversation-Rapid Fire
8. Story Telling
9. Narrating Life Stories
10. Tense Buster
11. Describing people
12. Picture Perception & Description
13. Movie Reviews
14. News Articles-Open Discussion & Debate
15. Everyday Life-Communicative Activities
16. Role Plays
17. Short Versions
18. Contemporary Novels-Critical Appreciation Round

References:

* Contemporary Novels-Critical Appreciation Round
* eslflow.com/Personality Vocabulary Survey
* eslflow.com/Celebrity Interview
* eslflow.com/Telling stories
* eslflow.com/ First Impressions/speaking activity
* Speaking work sheets/Out & About 1 - PHOTOCOPIABLE, Cambridge University Press 2015
* Speaking Unplugged: 30 activities for one-to-one classes by online TEFL training
* Think Teen work book
* The guardian weekly/News based English language activities
* Walkietalkie https://www.teacherspayteachers.com/Store/Walkietalkie
* Alen Maley's Conversation/Rob Nolasco & Lois Arthur/Oxford University Press
* Alen Maley's Project Work/Diana L.Fried-Booth/Oxford University Press
* Cambridge English/Objective PET/Louise Hashemi & Barbara Thomas
* Cambridge English Business Benchmark/Guy Brook-Hart
* British Council / Learn English Select Face-to-Face Course / APSCHE Communication Skills Project
* Self- Designed Handouts

EEV 02 :: AI Tools, Techniques and Applications
Semester III [Second Year]

L	T	P	C	Int	Ext
2	-	2	-	100	-

[Artificial Intelligence Tools, Techniques and Applications]

Course Outcomes:
Upon successful completion of the course the student will be able to:

1. Discuss the importance of AI.
2. Explain the concepts of Machine Learning algorithms and their limitations.
3. Describe the role of natural language processing in building chatbots.
4. Summarize the applications of Speech Recognition and Synthesis.
5. Analyse complex problems involving image processing, such as quality control, visual surveillance, multimodal human-machine interfaces, and image compression.

Unit I: Introduction to Artificial Intelligence
Basics of AI. Applications of AI. Heuristic search techniques, Knowledge Representation

Unit II: Machine Learning
Supervised, Unsupervised, and Semi-Supervised Learning, Deep Learning, Reinforcement Learning

Unit III: Natural Language Processing
Overview of NLP, The Components of NLP, Enterprise Applications of NLP; Chatbots: Introduction to a Chatbot, Architecture of a Chatbot

Unit IV: Computer Vision
Image Classification and Tagging, Object Localization, Custom Classifiers, How to Use Computer Vision, Use Cases, Best Practices, Existing Challenges in Computer Vision, Implementing a Computer Vision Solution

Reference Books
1. Elaine Rich & Kevin Knight, Artificial Intelligence, 2nd Edition, (Tata McGraw Hill Edition).
2. Tom Markiewicz and Josh Zheng, Getting started with Artificial Intelligence, O'Reilly Media, 2017

EEV 03 :: Electric Vehicle Technology

Semester III [Third Year]

L	T	P	C	Int	Ext
2	-	2	-	100	-

Course Objectives:

1. Explain the basics of electric vehicles, their architecture, technologies and fundamentals.
2. Demonstrate different battery configurations of electric vehicles and various types of machines in electric vehicles Configuration by drive train unit and characteristics.

Course Outcomes:

After successful completion of the course, the students are able to

1. Explain the basics of electric vehicles, their architecture, technologies and fundamentals.
2. Explain the use of Batteries used for electric vehicles, their technologies.
3. Analyze the use of different electrical machines in electric vehicles.
4. Develop the electric vehicle drive train unit and its characteristics.

COURSE CONTENT:

Unit-1: Introduction to Electric Vehicles

EV System – Components of EV - EV Advantages – Vehicle Mechanics – Roadway fundamentals – Vehicle kinetics, Dynamics of vehicle motion – Velocity and Acceleration - Propulsion System Design.

Unit-2: Battery

Basics – Types, Parameters – Capacity, Discharge rate, State of Charge, state of Discharge, Depth of Discharge, Technical Characteristics, Battery pack design, Properties of Batteries – Constant current Discharge approach.

Unit-3: DC & AC Electric Machines

Motor and engine ratings – Motor Requirements – DC Machines – Three Phase AC Machines – Induction Machines – Permanent Magnet (PR) Machines – Switched Reluctance (SR) Machines.

Unit-4: Electric Vehicle Drive Train

Electric Vehicle Transmission Configurations – Components – Gears, Automobile Differential, Clutch, Brakes – Gear Box, gear ratio, Torque-speed characteristics – EV Motor Sizing.

Learning resources:

Text books:

1. Iqbal Husain, ELECTRIC and HYBRIDVEHICLES, Design Fundamentals, CRC Press,2003.
2. James Larminie, John Lowry, “Electric Vehicle Technology”, Wiley publications, 1st Edition, 2003.

Reference books:

1. Seth Leitman, “Build Your Own Electric Vehicle” MC Graw Hill, 1st Edition, 2013.
2. B D McNicol, D A J Rand, “Power Sources for Electric Vehicles”, Elsevier publications, 1st Edition, 1998.
3. M. Ehsani, Y. Gao, S. Gay and A. Emadi,Modern Electric, Hybrid Electric, and Fuel CellVehicles, CRC Press, 2005
4. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press, 2001.
5. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011.

MC001 :: CONSTITUTION OF INDIA

L	T	P	C	Int	Ext
2	0	0	-	100	-

COURSE OBJECTIVES:

To provide basic information about Indian Constitution.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Understand the significance of many provisions of the Constitution as well as to gain insight into their back ground. They will also understand number of fundamental rights subject to limitations in the light of leading cases.
2. Study guidelines for the State as well as for the Citizens to be followed by the State in the matter of administration as well as in making the laws. It also includes fundamental duties of the Indian Citizens in Part IV A (Article 51A).
3. Understand administration of a State, the doctrine of Separation of Powers.
4. Know how the State is administered at the State level and also the powers and functions of High Court.
5. Understand special provisions relating to Women empowerment and also children. For the stability and security of the Nation, Emergency Provision are Justified.
6. Understand election commission as an independent body with enormous powers and functions to be followed both at the Union and State level. Amendments are necessary, only major few amendments have been included.

UNIT I [CO:1] (10)

Preamble to the Constitution of India Domicile and Citizenship. Fundamental rights under Part III, Leading Cases. Relevance of Directive Principles of State Policy under Part-IV, IV-A Fundamental duties.

UNIT II [CO:2,3] (10)

Union Executive - President, Vice-President, Prime Minister, Union Legislature - Parliament and Union Judiciary - Supreme Court of India. State Executive - Governors, Chief Minister, State Legislature and High Court.

UNIT III [CO:3,5] (10)

Special Constitutional Provisions for Scheduled Casters and Tribes, Women and Children and Backward Classes, Emergency Provisions.

UNIT IV [CO:6] (10)

Electoral process, Centre State Relations (Amendment Procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments).

LEARNING RESOURCES:

TEXT BOOK:

Durga Das Basu: "Introduction to the Constitution of India" (student edition) Prentice - Hall EEE, 19th/20th Edition, 2001.

REFERENCE BOOK(s):

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI, Learning Pvt.Ltd., New Delhi, 2011.

MC002 :: ENVIRONMENTAL SCIENCE

[MANDATORY NON-CREDIT COURSE – ACTIVITY BASED]

L	T	P	C	Int	Ext
2	0	0	0	100	-

COURSE OBJECTIVES:

1. Understand that humans are an integral part of environment and hence their activities reflect on the environment
2. Realize and appreciate the importance of ancient practices and their importance in the present times
3. Appreciate the contribution of individuals for the upkeep of environmental standards, in turn help the humans live better.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Evaluate the implications of human activities and thereby promote eco friendly technologies
2. Promote awareness among the members of the society for a sustainable environment
3. Include and give priority to environmental protection in all developmental projects

A. AWARENESS ACTIVITIES – SMALL GROUP MEETINGS

I. Source of water for human consumption/activities:
   a. collection of information pertaining to water resources and consumption in Andhra Pradesh
   b. Water resource on campus: General/Laboratory use and
   c. Drinking water – understand the background and adopt judicious management.
   d. Recycled water for Gardening – Particularly Lawns.
   e. Cut down wastage of electricity in class rooms/labs/hostels etc. by avoiding misuse.

II. After the group meetings and exposure to the local issues and healthy practices, students motivated to make:
   a. Posters b. Slogans/One liners for promoting awareness

III. Lectures from Experts (at least 2 in the course duration)

IV. A walk in the neighbourhood to promote a chosen theme on environmental consciousness.

B. ACTUAL ACTIVITIES

1. Plantation on Campus and on the sides of approach road.
2. Distribution of saplings to the local colony dwellers and encourage plantation.
3. Development of Kitchen garden on campus – Cultivation of atleast leafy vegetables and creepers like cucumber etc. for use in college canteen/hostels etc.
4. Adoption of "NO PLASTICS" on campus.
5. Field trip to gain knowledge of biodiversity, water shed, mining, pollution and other local issues.
6. Preparation of working models for energy generation/transformation etc.

C. THEORY SYLLABUS FOR ASSESSMENT

Part-I

1. Introduction to Environmental Studies, Scope and Importance.

2. Natural resources Renewable and Non-Renewable; Definition and importance of the following resources in detail: a. Forest b. Water c. Land d. Energy

3. Sustainable development - Concept and Measures.

4. Biodiversity - Definition, Types of Biodiversity, Values and threats to Biodiversity, Conservation of biodiversity, IUCN classification: Endangered, Threatened, Vulnerable, Rare species;
Endemic and Exotic species.

5. Climate change - Global warming, Ozone depletion and Acid rain.

Part-II

6. Water shed, water shed management in detail.
7. Solid wastes and Solid waste management.
8. Environmental Legislation, Environmental acts - Wild life protection act, Water act, Forest conservation act, Air act and Environmental protection act.
9. Case studies: Chernobyl nuclear disaster, Bhopal gas tragedy, Narmada bachao andolan, Silent valley, Story of Tuvalu, Story of Ganga.
10.Earth summit and Kyoto protocol; Measures at individual level for conservation of natural resources and sustainable development.

Text Books:

1. Anubha Kaushik and C.P.Kaushik - Environmental Studies, 3rd Edition, New Age International Publishers, New Delhi., 2012.
2. R. Rajagopalan - Environmental studies from crisis to cure, 3rd Edition, Oxford University press, 2012.

ASSESSMENT

1. Two assessments each of 40 marks will be done in the semester. The split up of each assessment is as follows:
a. Two internal theory examinations will be conducted for 18 marks each.
b. Evaluation of the prepared activity sheets and working models will be done for 12M (continual evaluation) twice in the semester in line with the theory examination.
c. 5 Marks for attendance and 5 marks for oral test.
Note: Weightages for a, b & c will be taken as per the assessment guidelines of the R-18 curriculum and projected to 100 marks.

MC003 :: Essence of Indian traditional knowledge

(Common for all Branches)

L	T	P	C	Int	Ext
2	0	0	0	100	-

COURSE OBJECTIVES:

To Facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.

COURSE OUTCOMES:

At the end of the course, the students are able to

1. Understand the concept of traditional knowledge and its importance.
2. Apply significance of traditional knowledge protection.
3. Analyze the various enactments related to the protection of traditional knowledge.
4. Evaluate the concepts of intellectual property to protect the traditional knowledge and the traditional knowledge in different sectors .

COURSE CONTENT:

UNIT I **[CO:1] (8)**

Introduction to traditional Knowledge: Definition of traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge,characteristics, the historical impact of social change on traditional knowledge syatems, traditional knowledge VS western knowledge, traditional knowledge vis-a-vis formal knowledge.

UNIT II **[CO:2] (8)**

Protection of traditional knowledge: the need for protecting traditional knnowledge, Significance of TK Protection, Value of TK in global economy, Role of Government to harness TK.

UNIT III **[CO:3] (8)**

A:Legal framework and TH: The Scheduled Tribes and Other Traditional Forest Dwellers(recognition of Forest Rights) ACt 2006; Plant Varities Protection and Farmer's Rights Act,2001 (PVPFR ACT)

B: The Biological Diversity Act 2002 and Rules 2004 and the protection of traditional knowledge bill, 2016

UNIT IV **[CO:4] (8)**

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and Traditional knowledge, Strategies to increase protection of traditional knowledge, Traditional knowledge in different sectors; Engineering, Medicine syatem, biotechnology and agriculture, Managment of biodiversity, Food security of the country and protection of TK.

LEARNING RESOURCES:

TEXT BOOK:

Traditional Knowledge System in India, by Amit Jha, ATLANTIC Publishers, 2009.

REFERENCE BOOK(s):

1. Traditional Knowledge System and Technology in India by Basanta Kumar, Mohanta and Vipin Kumar Singh ,PratibhaPrakashanPublishers,2012.
2. Knowledge Traditions and Practices of India by Kapil Kapoor and Michel Danino.

WEB RESOURCES:

1. http://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

MC004 :: Design thinking & product innovation

Semester IV [Second Year]

L	T	P	C	Int	Ext
2	-	-	-	100	-

COURSE OBJECTIVES:

1. Identify the design thinking processes and methods.
2. Plan research activities to gather and empathize from a user's viewpoint.
3. Ideate techniques to help arrive at the best solution and evaluation.
4. Identify design thinking approaches for business challenges.

COURSE OUTCOMES:

On completion of this course, students will be able to:

1. Interpret the concepts of Design thinking.
2. Investigate a problem to determine its root cause.
3. Take part in group thinking and experiment with different solutions.
4. Develop innovative thinking and creative problem solving.

UNIT – I [CO1]

Introduction to Design Thinking – Origin of Design Thinking, Features & Principles of Design Thinking, Applications of Design Thinking, Role of Research in Design Thinking. [8periods]

UNIT – II [CO 2]

Modules of Design Thinking – Inspiration – methods & tools used in Explore and Empathize phases of Design Thinking, Case study-activity. [8periods]

UNIT – III [CO 3]

Modules of Design Thinking– Ideation & Implementation – methods &tools used in Experiment, Engage and Evolve phases of Design Thinking, Case study-activity. [8periods]

UNIT – IV [CO 4]

Design Thinking applied in Business & Strategic Innovation – Ten Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization, Creative Culture, Strategy & Organization – Design Thinking approaches. [8periods]

LEARNING RESOURCES:

TEXT BOOKS:

1. "Design Thinking for Entrepreneurs and Small Businesses" by Beverly Rudkin Ingle, Apress. [UNIT -1]
2. "Change by design", Tim Brown, Harper Collins, 2009 [UNIT -1]
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan.[UNIT –II & III]
4. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013).[UNIT -IV]

REFERENCE BOOKS:

1. "Design Thinking Business Innovation", Rio de Janeiro – 2012 1st edition, MJV press.
2. "Design Thinking- Understanding How Designers Think and Work" by Nigel Cross, Berg publishers.

WEB REFERENCES:

- IDEO: Design Thinking for Educators toolkit https://designthinkingforeducators.com/.
- https://dschool.stanford.edu/resources/a-virtual-crash-course-in-design-thinking
- https://dschool-old.stanford.edu/groups/designresources/wiki/4dbb2/ (wallet Project)

HSEL01 :: Industrial Management & Entrepreneurship

L	T	P	C	Int	Ext
3	-	-	3	40	60

COURSE OBJECTIVES:
COURSE OUTCOMES:
UNIT I ()
UNIT II ()
UNIT III ()
UNIT IV ()
LEARNING RESOURCES:

HSEL02 :: ECONOMICS FOR ENGINEERS

L	T	P	C	Int	Ext
3	-	-	3	40	60

COURSE OBJECTIVES:

1. To provide the students with knowledge of basic economic problems and the relationship between engineering technology and economics.
2. To make the students understand the demand determinants and the methods of demand forecasting of a product.
3. The students gain the knowledge about various cost concepts for determining the manufacturing of a product.
4. To sensitize the students about the changing environment of banking scenario and to understand the functions of RBI.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Understand the basic economic problems and objectives of a firm.
2. Get knowledge about overall functions and concepts of Demand elasticity of the firm and forecasting.
3. Linkage of various cost concepts and to understand how to sustain break even for a business.
4. Know the overview of Liberalization, Privatization and Globalization and their impact on Indian economy.

UNIT I

Text Book - 1,2 [CO:1] **(15)**

ENGINEERING ECONOMICS: Economics definition - Functions & Scope of Engineering economics - Basic economic problem - Relationship between Science - Engineering - Technology - Economics.FIRMS OBJECTIVE: Theories of Maximization - Profit Maximization - Wealth Maximization - Growth Maximization - Sales Revenue Maximization - Utility Maximization.

UNIT II

Text Book - 2,3 [CO:2] **(15)**

THEORY OF DEMAND: Demand Definition - Nature and Characteristics of Demand - Demand schedule Law of demand - Limitations to the law of demand - Various concepts of Demand Elasticity - Price Elasticity - Income Elasticity - Cross elasticity - Demand Forecasting definition - Factors determining Demand Forecasting - Methods of Demand forecasting.

UNIT III

Text Book - 4 [CO:3] **(15)**

COST CONCEPTS: Introduction - Types of costs - Fixed cost - Variable cost - Average cost - Marginal cost - Real cost - Opportunity cost - Accounting cost - Economic cost - Break - Even analysis.

UNIT IV

Text Book - 4 [CO:4] **(15)**

INDIAN ECONOMY - AN OVERVIEW : Nature and characteristics of Indian economy - Banking

-Structure of Indian Banking- RBI functions - Functions of Commercial banks - Merits and Demerits of Liberalization - Privatization - Globalization(LPG) - Elementary concepts of WTO - GATT- GATS - TRIPs - TRIMs - Monetary Policy - Fiscal Policy.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Riggs, Bedworth and Randhwa, Engineering Economics, McGraw-Hill Education India.

2. S.C.Sharma and T.R.Banga, Industrial Organisation and Engineering Economics, Khanna Publishers.
3. S.K.Misra and V.K.Puri, Economic Environment of Business, Himalaya Publishing House.
4. H.L.Ahuja, Managerial Economics, S.Chand Publishing.

REFERENCE BOOK(s):

1. Singh A and Sadh A.N., Industrial Economics , Himalaya Publishing House , Bombay
2. R.L.Varshney & K.L.Maheswari, Managerial Economics,S.Chand Publishing ,2003 Edition
3. Datt & Sundharam, Indian Economy , S.Chand Publishing, 2014 Edition

WEB RESOURCES:

1. www.managementstudyguide.com: Describes about the amalgamation of economic theory with business practices.
2. www.tutorialspoint.com: Provides a platform to learn various courses discussed in the syllabus.

HSEL03 :: INTRODUCTION TO INDUSTRIAL MANAGEMENT

L	T	P	C	Int	Ext
3	-	-	3	40	60

COURSE OBJECTIVES:

1. To provide the students a foundation in concepts and skills in management.
2. To make the students understand the concept of interest and evaluation of project alternatives.
3. Prepare the students for facing the changing environment, its implication on human resources and to achieve the corporate excellence.
4. Provide awareness about the materials requirement and procurement, in order to produce good quality products and maintain quality as desired by the consumer.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. become aware of the inference of organization structure and performance of people working in organizations.
2. get knowledge about time value of money, evaluation of alternatives in the changing economic environment.
3. understand the elements of human resource management to acquire competitive advantage.
4. use right sort of material for delivering the right products and services to the market.

UNIT I

Text Book - 1 [CO:1] **(15)**

GENERAL MANAGEMENT: Management Concept, Managerial levels, Managerial Skills, Managerial levels v/s skills, Brief treatment of managerial functions, Scientific Management Principles, Administrative Principles of Management. FORMS OF BUSINESS ORGANISATION: Salient features of sole proprietorship. Partnership, Joint Stock Company, Private limited and Public limited companies.

UNIT II

Text Book - 1 [CO:2] **(15)**

FINANCIAL MANAGEMENT: Objectives of Financial Management - Concept of money - Simple interest - Compound interest - Equivalent cash flow diagramECONOMIC EVALUATION OF ALTERNATIVES: Basic methods - the annual equivalent method - present worth method - future worth method.DEPRECIATION: Purpose - Definition - types of depreciation - common methods of depreciation - The Straight Line Method - Diminishing Balance Method - the Sum of the Years Digits Method.

UNIT III

Text Book - 1 [CO:3] **(15)**

HUMAN RESOURCE MANAGEMENT:Functions of Human Resource Management - Job Analysis - Human Resources Planning - Brief treatment of Recruitment - Selection - Placement - Induction & Orientation - Training and Development - Performance Appraisal.

UNIT IV

Text Book - 1 [CO:4] **(15)**

MATERIAL MANAGEMENT: Functions of Materials Management - Material Requirement Planning - Purchasing - Objectives of Purchasing - Sources of Selection - Procurement Methods - Vendor Rating - Inventory Management - EOQ - EPQ - ABC Analysis.MARKETING MANAGEMENT: Functions of Marketing - Marketing Mix - Product life cycle - Channels of distribution - Marketing Segmentation - Advertising & Sales promotion - Market Research.

LEARNING RESOURCES:

TEXT BOOK(s):

1. KK Ahuja, Industrial Management and Organizational Behaviour, Khanna Publishers.
2. Pravin Kumar, Industrial Engineering and Management, Pearson Publications.
3. N.V.S.Raju, Industrial Engineering and Management, Cengage Learning.

REFERENCE BOOK(s):

1. Philip Kotler, Marketing Management, 11th Edition, Pearson Education.
2. Gary Dessler, Human Resource Management, Pearson Education11th Edition.
3. Heinz Weirich and Harold Koontz, Management, 10th Edition, TMH.

WEB RESOURCES:

1. www.managementstudyguide.com: Describes the Concepts of Management & Its Operational Functions.
2. www.1000 ventures.com: Describes about Management Gurus, Business Gurus.
3. www.citehr.com: Describes the Human Resource Management Topics.

HSEL04 :: PROJECT MANAGEMENT & ENTREPRENEURSHIP

L	T	P	C	Int	Ext
3	-	-	3	40	60

COURSE OBJECTIVES:

1. To develop Entrepreneurial creativity and Entrepreneurial initiative, adopting the key steps in the elaboration of business idea.
2. To be aware the growth and development of Entrepreneurial process and the resources needed for the successful development of Entrepreneurial ventures.
3. To grasp the project identification, Planning and execution of the projects.
4. To understand the project analysis, apply appropriate project tools and techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. utilize the ideas to create value.
2. self-advocacy and problem solving skills and manage strong identity purpose.
3. Understand the conceptual clarity about project identification, formulation and feasibility analysis.
4. Analyse the learning and implementation of the project techniques for project planning, scheduling and execution.

UNIT I [CO:1] **(15)**

Entrepreneurship:An overview of Entrepreneurship - Characteristics and competencies of Entrepreneur - Entrepreneurial traits - Classification of Entrepreneurs - functions of Entrepreneur - Distinction between entrepreneur, Intrapreneur and manager - Entrepreneurial decision process

UNIT II [CO:2] **(15)**

Entrepreneurship growth and Development:Factors affecting Entrepreneurial Development - Economic and Non-Economic factors - Entrepreneurial Development Programs - Need and objectives of EDP - EDP programs in India - Entrepreneurial Motivation - theories of Maslow's and Mc Clelland's - MSME an introductory framework.

UNIT III [CO:3] **(15)**

Project Identification and Formulation: Meaning and definition of Project - concepts - Project Life cycle - Project Identification - Project Selection - Source of Finance for a Project - Project appraisal - Technical, Financial, Market appraisal - preparation of detailed project report.

UNIT IV [CO:4] **(15)**

Implementation of project: An overview of Project Planning and Scheduling - Management and Control of Projects - Network Analysis - PERT and CPM.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Dr. S.S Khanka, Entrepreneurial Development, S. Chand and Company limited, New Delhi.
2. H. Nandan, Fundamentals of Entrepreneurship, PHI, New Delhi.
3. Prasanna Chandra, Project Planning, Analysis, Selection, Implementation and Review, Tata McGraw

Hill.

4. Rao. P.C.K., Project Management & Control, S. Chand, New Delhi.

HSEL05 :: HUMAN RESOURCES & ORGANISATIONAL BEHAVIOUR

L	T	P	C	Int	Ext
3	-	-	3	40	60

COURSE OBJECTIVES:

1. To familiarize the student with the fundamental aspects of various issues associated with Human Resource Management and Organizational Behaviour.
2. This course aims to give a comprehensive overview about Career Planning, theories of Motivation and styles of Leadership.
3. To introduce the basic concept of Individual Behaviour.
4. To enhance the awareness of Group Behaviour.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. know the Functions of Human Resource Management, Job Description and Job Specification
2. familiarize with the concepts in Compensation, Motivation and styles of Leadership
3. understand the Behaviour of people at individual level through the concepts of Perception, Learning and Personality
4. comprehend the Group and Team Dynamics in an Organization.

UNIT I [CO:1] (15)

Human Resource Management: Nature - significance - functions of HRM - .Job Analysis - Objectives and methods of Job Analysis - Job Description - Job Specification - Job Rotation - Job Enlargement - Job Enrichment - Job Evaluation & its Methods.

UNIT II [CO:2] (15)

Career Planning & Motivation: Career Planning and Development - Career Stages - Compensation - Components of Pay Structure - Wage and Salary administration - Incentives and Employee Benefits - Motivation: Maslow's Theory - Herzberg's Two Factors Theory of Motivation - McGregor's Theory X and Y - Vroom's Expectancy Theory - Leadership: Theories of Leadership and its Styles.

UNIT III [CO:3] (15)

Introduction to Organizational Behaviour: Meaning- Importance - Nature & Scope of OB - Contribution of other Disciplines to OB - Need for Development of individual Skills; Perception - Process of Perception - Enhancing Perceptual Skills - Learning - Theories of learning - Personality - Stages of personality Development - Determinants of personality.

UNIT IV [CO:4] (15)

Groups and Teams: Meaning & Definition of Group and Group Dynamics - Dynamics of Group Formation - Reasons for Group Formation - Types of Groups - Concept and Definition of Team - Types of Teams - Work Teams - Cross-functional Teams - Virtual Teams - Group/Team Effectiveness - How to make Teams more Effective - Team Building - Collaboration - Group Leadership.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Aswathappa.K., Human Resource Management, Text and Cases 8th Edition, McGraw Hill, New

Delhi.
2. De Cenzo. & Stephen P. Robbins, Personnel/ Human Resource Management, Pearson Publications.
3. Stephen P. Robbins, Organisational Behavior, PHI, 9th edition
4. Fred Luthans, Organisational Behaviour, Tata McGraw Hill.-12th Edition.

REFERENCE BOOK(s):

1. VSP Rao, Human Resource and Personnel Management, PHI
2. Edwin B. Flippo, Personnel Management, McGraw-Hill.
3. Aswathappa.K., Organisational Behaviour , Himalaya Publishing House, New Delhi
4. Jai, B.P.Sinha, "Culture and Organisational Behaviour", Sage Publications

HSEL06 :: ETHICS & HUMAN VALUES

L	T	P	C	Int	Ext
3	-	-	3	40	60

COURSE OBJECTIVES:

1. To create awareness to specific set of morals, values and ethics the professional must know and abide by, including work ethics, integrity and commitment etc.
2. To realize the importance of moral autonomy, professional ideals and Ethical theories
3. To study safety/risk aspects ,welfare of the public and about employee rights
4. Know about the global issues and code of ethics of professional bodies

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Have basic understanding of how a prospective engineer should behave in his chosen field and society.
2. Realize the importance of moral autonomy, professional ideals and Ethical theories.
3. Know about the safety/ risk , welfare of the public and employee rights
4. Gain exposure to global issues and codes of some professional bodies

UNIT I [CO:1] (15)

Human Values : Morals, Values And Ethics - Integrity- Work Ethics- Service Learning - Civic Virtue- Respect For Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Co-Operation - Commitment - Empathy - Self-Confidence - Character - Spirituality.

UNIT II [CO:2] (15)

Engineering Ethics: Senses Of Engineering Ethics- Variety of Moral Issues - Types of Inquiry - Moral Dilemmas - Moral Autonomy - Kohlberg's Theory - Gillian-s Theory - Consensus and Controversy Professions and Professionalism: The nature and characteristics of Professions, Professionalism, the foundation and norms of Professional ethics, the need for separate code of conduct for Professionals, Professional Rights, Theories about Right Action, Uses of Ethical Theories. Case studies like The Space Shuttle Challenger, Bhopal gas tragedy, Chernobyl disaster etc.

UNIT III [CO:3] (15)

Engineering as Social Experimentation: Engineering As Experimentation - Engineers As Responsible Experimenters Safety, Responsibilities and Rights: Safety and Risk - Assessment of Safety And Risk - Risk Benefit Analysis And Reducing Risk.Collegiality And Loyalty - Respect For Authority -Collective Bargaining - Confidentiality - Conflicts Of Interest - Occupational Crime - Employee Rights - Intellectual Property Rights (IPR)- Discrimination.

UNIT IV [CO:4] (15)

Multinational Corporations - Environmental Ethics - Computer Ethics - Business ethics - Engineers As Managers - Consulting Engineers - Engineers As Expert Witnesses and Advisors - Codes Of Ethics - Sample Code Of Ethics Like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management Etc.,

LEARNING RESOURCES:

TEXT BOOK(s):

1. Mike martin and Ronald Schinzinger, "Ethics in Engineering" McGraw-Hill, New York 1996
2. Govindarajan M, Natarajan S, Senthil Kumar V.S., "Engineering Ethics", PHI, New Delhi, 2004
3. Bayles.M.D, Professional ethics, California, Wardsworth publishing company,1981
4. Koehn.D, The ground of Professional Ethics, Routledge,1995

REFERENCE BOOK(s):

1. Charles D,Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint)
2. Charles E Harris, Michael S.Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases" Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, "Ethics and the conduct of business" Pearson, New Delhi, 2003.
4. Edmund G.Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers" Oxford University Press, Oxford, 2001.

CS/EC/IT 113 CH/ME 123 & CE 223 :: Basic Electrical Engineering
Semester I / II [First Year]

L	T	P	C	Int	Ext
0	0	2	1	40	60

COURSE OBJECTIVES:
1. To introduce fundamental laws, basic electrical elements, sources and their characteristics.
2. To develop the ability to apply circuit analysis to AC circuits.
3. To provide students with fundamental concepts on the construction and operation of transformers and electrical machines.

COURSE OUTCOMES:
After successful completion of the course, the students are able to
1. understand the basic electrical circuits and batteries.
2. gain the knowledge on the concept of AC circuits.
3. get the knowledge on the principle and operation of single phase transformer
4. understand the operation of electrical machines.

UNIT I [CO:1] (15)
Batteries: Lead-acid, Nickel-iron, Nickel-Cadmium batteries (Operation only). Elementary calculations for energy consumption.
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

UNIT II [CO:2] (15)
AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III [CO:3] (15)
Transformers: Magnetic materials, BH characteristics, working principle of single phase transformer, ideal and practical transformer, equivalent circuit form O.C and S.C tests. Losses in transformers, regulation and efficiency. Auto-transformer - Working principle, comparison with two winding transformer.

UNIT IV [CO:4] (15)
Electrical Machines: Construction, working principle of DC generator and motor (Elementary treatment only), torque-speed characteristic of separately excited dc motor.
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic.
Loss components and efficiency. Construction and working of synchronous generators.

LEARNING RESOURCES:
TEXT BOOK(s):
1. T.K.Nagasarkar and M.S.Sukhija - Principles of Basic Electrical Engineering, Oxford University Press, 2018.
2. D. P. Kothari and I. J. Nagrath - Basic Electrical Engineering, Tata McGraw Hill, 2010.
REFERENCE BOOK(s):
1. D. C. Kulshreshtha - Basic Electrical Engineering, McGraw Hill, 2009.
2. L. S. Bobrow - Fundamentals of Electrical Engineering, Oxford University Press, 2011.
3. E. Hughes - Electrical and Electronics Technology, Pearson, 2010.
4. V. D. Toro - Electrical Engineering Fundamentals, Prentice Hall India, 1989.
5. J.B Gupta - Basic Electrical Engineering, S.K.Kataria & Sons, 6th Edition 2015.
WEB RESOURCES:
1. http://www.egate.ws/
2. http://cosmolearning.org/courses/circuit-theory/
3. http://www.nptelvideos.in/2012/11/circuit-theory.html
4. http://elearning.vtu.ac.in/P9/notes/06ES34/Unit1-KCV.pdf

5. http://pbtstudies.blogspot.in/

CS/EC/IT 152 CH/ME 164 & CE 261 :: Basic Electrical Engineering Laboratory
Semester I / II [First Year]

L	T	P	C	Int	Ext
0	0	2	1	40	60

Course Objectives:
Main objectives of this lab course are
1. To conduct experiments in electrical circuits.
2. To design experimental setups for theorems.
3. To conduct experiments related to transformers and electrical machines.
4. To familiarise various electrical installations and testing equipment.

Course Outcomes:
Upon completion of this laboratory, the student will be able to:
1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of resonance.
5. Verify the network theorems.

List of experiments/demonstrations:

1. Familiarisation of Electrical Installations and Electrical Testing Equipment: Miniature circuit breakers (MCBs), Moulded Case Circuit Breakers (MCCBs), Earth-leakage circuit breakers (ELCBs), Fuses, Types of Wires, Wire Gauges, continuity test, megger, Cables and Earthing.
2. Basic safety precautions. Introduction and use of measuring instruments - voltmeter, ammeter, wattmeter, multi-meter, oscilloscope, measurement of basic parameters.
3. Verification of KVL& KCL.
4. Verification of Superposition Theorem.
5. Verification of Thevenin's Theorem.
6. Verification of Norton's Theorem.
7. Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
8. OC & SC tests on single phase transformer.
9. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
10. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
11. Swinburne's test on dc motor.
12. Speed control of dc motor.
13. Experiments on three-phase induction motors. Direction reversal by change of phase-sequence connections, Torque-Slip Characteristics of an induction motor.
14. Synchronous Machine operating as a generator: stand-alone operation with a load, control of voltage through field excitation.
15. Determination of choke coil parameters.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.