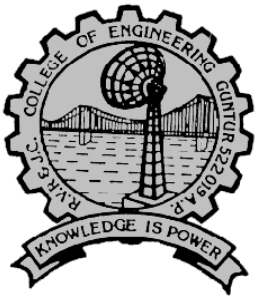
R V R & J C COLLEGE OF ENGINEERING, CHOWDAVARAM, GUNTUR-19
(Autonomous)



R-16 REGULATIONS & SCHEME

CHOICE BASED CREDIT SYSTEM

Regulations, Scheme of Instruction, Examination and Detailed Syllabi for 4-Year B.Tech Degree Course in Electrical & Electronics Engineering (Semester System)

w.e.f. : 2016-2017

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.

The Mission

An integrated development of manpower possessing technological and managerial knowledge and skills, values and ethics needed to make an honorable living and contribute to the socio-economic development and welfare of the society.

The Genesis and Growth

Like all great institutions, the College too had a humble beginning with just 180 intake and a barely adequate infrastructure in1985, it is the determination and commitment of the Management that made the College one of the largest among Engineering Institutions in South India with excellent infrastructure, facilities and competent human resources. Today, it offers eight B.Tech., Degree Courses with an intake of 1080 plus 216 through lateral entry into the II Year for Diploma Holders. Further, the College offers MBA, MCA and M.Tech. in six specializations with an intake of 355. The total intake is 1435.

In 1998 it has become the youngest College to have been accredited and as on date all the seven eligible B.Tech. Degree Courses have been accredited in 2002, 2007 and again in 2012. It has became the first Engineering College in the state to have been accredited fourth time by N.B.A., New Delhi. In 2014, the Institution was accredited by NAAC with 'A' Grade for FIVE Years by getting 3.19 CGPA on 4 point Scale. Further in the Academic Audit and Grading done by Andhra Pradesh State Council of Higher Education, Govt. of A.P., the institute is rated as the SECOND best among Private Engineering Colleges of A.P. and FOURTH best amongst all Engineering Colleges of A.P. including University Engineering Colleges. It has also figured among the "Top-100" Engg. Colleges in independent surveys conducted in 2006 & 2007 by the popular magazine the "OUTLOOK". The College received Best Laboratory Award, Eco Friendly Campus and First Prize for Best Performing Professional UG College in University Examination Results for the last FIVE consecutive years from Acharya Nagarjuna University. The College is a typical example of meticulous planning, resource scheduling, human endeavour and institutional management.

COURSES OFFERED

1) Under-Graduate: B.Tech

i)	Civil Engineering (1985)	180
ii)	Mechanical Engineering (1985)	180
iii)	Electronics & Communication Engg. (1985)	180
iv)	Electrical & Electronics Engg. (1994)	180
v)	Computer Science & Engineering (1994)	180
vi)	Chemical Engineering (1996)	60
vii)	Information Technology (1998)	120

2) Post-Graduate:

i)	Management Sciences (MBA) (1995)	120
ii)	Computer Applications (MCA) (1995)	120
iii)	M.Tech in Computer Science & Engineering (2003)	25
vi)	M.Tech in Power Systems Engineering (2004)	18
v)	M.Tech. Structural Engineering (2004)	18
vi)	M.Tech. Communication Engineering and Signal Processing(2011)	18
vii)	M.Tech. in Machine Design (2013)	18
viii)	M.Tech. in Computer Science & Technology (2013)	18

The Campus

A built up area of 65,985 sq.m. on a 37.41 acres plot houses 61 Laboratories and 18 Computer Centres besides amenities like Canteen, Seminar Halls, Auditorium, Open Air Theatre, Gymnasium, e-classrooms and Conference Halls etc. to make life in the classroom and outside easy and comfortable. Continuous power supply is provided from 200 kVA, 250 kVA and 500 kVA modern Generator sets. Andhra Bank Branch is located in the campus. A fleet of 28 buses save the staff and students from the vagaries of public transport. The aesthetically designed structures, the hill slopes on the West, a well laid out campus dotted with roads, trees and gardens merge into a stunning landscape that inspires the minds to "Think Better, Work Better".

The Work Culture

The Management and Staff are a group of uncompromising people who stretch beyond reasonable limits to attain their objective - Excellence in everything they do. The people of RVR & JC have learnt that meeting of the minds and joining hands is the easier way to success. They do meet and interact frequently to set new starting lines than to celebrate the finishing lines reached.

The People

The College is possessive of its intellectual property; 350 strong Faculties, out of which 67 having PhDs, with diversity in specialization and heterogeneity in abilities have unity in their objective of enriching the students with up-to-date technical information, data and skills. The teachers adopt a very professional attitude and commitment in imparting instruction, counseling and personality development in which the student has the final say. The emphasis is more on

learning of the student than on teaching. All our teachers are rated 90% good by the students. The 165-odd administrative and supporting people provide the logistics to run academic and administrative operations, with silent efficiency.

Discipline

Insulating the students from the vulnerable influence due to the society's contemporary aberrations is our endeavor. The institution had become the choice of the parents for its track-record of campus discipline. The ambience and the exemplary orderliness of behavior of the staff induce a self-imposed discipline in the students.

Computer Centres

The computer facilities are vast. About 1500 terminals with latest configuration are located in fourteen Central and Department Computer Centres, all air conditioned. Software necessary for effective training and instruction as well as for consultancy are in place. All the computers in the campus have been interconnected through campus-wide intranet using Fibre Optic cables and switches. The City Computer Centre is an off-time facility for students & staff. Examination & administrative services are Computerised. Currently, 45 MBPS Wireless Internet connectivity is provided by installing a Micro Tower.

Library

The four-storied library of 99,928 volumes of 28.616 titles, 3,800 CDs and educational films is the biggest learning resource in the campus. 114 National and International Journals and E-Journals (with an annual subscription of Rs.19.18 Lakhs) provide up-to-date information on any topic the students and staff look for. Orderly stacking, computerized information and the seven qualified library staff facilitate easy location of any information needed. The Digital Library is providing Video Lectures by NPTEL, world famous Institutions like MIT, etc.. Comfortable seating arrangement and large reading spaces provide a serene atmosphere for spending long hours in the library. Central Library works from 8.00am to 20.30pm The City Centre too has a reference library and á Computer Centre that is open upto 10.00 p.m.

Hostels

Four storeyed Girls hostel with a 7,250 sq.m. accommodating 700 girl students with modern facilities available. Four storied boys hostel with 20,180 sq.m. accommodating 1300 students with modern facilities in the College campus.

The Students

From the day of induction, the staff do everything to naturalize the students to the culture of R.V.R. & J.C. College of Engineering i.e. single minded pursuit of the objective. The part played by the students in making the College, into an ideal seat of learning is significant. The students of this College consistently produce the best of the results in the University.

Extra-curricular Activities

NCC, NSS Units are established in the College. Opportunities are a plenty for those with extracurricular talent. Numerous competitions are held for various levels of students, who have proved their superiority in various inter-collegiate competitions conducted by public organizations and other institutions. The students prove their leadership qualities and co-operative skills by organizing colorful functions at regular intervals.

Campus Recruitment

About 60 renowned industries / IT Organizations regularly visit the College to recruit the final years for employment. A training and placement Department monitors recruitment, short term training and personality development programmes. During the last four years the Campus recruitment steadily grew up to 600+ in 2015-16.

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EEE Department Vision:

"To impart education leading to highly competent professionals in the field of Electrical & Electronics 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:

The graduates of the program will be able to demonstrate

PSO1 Knowledge and hands on competence in developing, Testing, Operation and Maintenance of Electrical & Electronics systems.

PSO2 Knowledge and hands on competence in Modern Engineering tools to engage in life-long learning and to successfully adapt in multi disciplinary environments.

PSO3 Knowledge in Project Management techniques, environmental issues and Green technologies.

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.

4. **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.
5. **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.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **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 120 students from the academic year 2004 -2005. 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 and 2012.

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 42 experienced & dedicated Faculty and 11 Non – Teaching staff. Faculty of EEE department are specialized in the core areas of Electrical & Electronics Engineering like Power Systems, Power Electronics, 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

Vision of the Department is "**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.**"

Mission of the Department is **"The Integrated development of professionals with knowledge and skills in the fields of specialization and ethics and values needed for employability in the fields of Electrical Engineering and contribute to the economic growth of the employing organization and pursue lifelong learning."**

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."**

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. 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)
CHOICE BASED CREDIT SYSTEM REGULATIONS (R-16) 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 2016-2017).

1 MINIMUM QUALIFICATIONS FOR ADMISSION

A candidate seeking admission into I Year of B.Tech. Degree Course 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 II Year of B.Tech. Degree Course 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. Chemical Engineering
2. Civil Engineering
3. Computer Science & Engineering
4. Electrical & Electronics Engineering
5. Electronics & Communication Engineering
6. Information Technology
7. 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 II 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 OFFERED

5.1 A candidate has to register and secure 189 credits out of which 54 credits from laboratory courses including project work.

5.2 A candidate has to register 12 courses in First, Second and Third Years of study and 10 courses in Fourth year of study.

5.3 A candidate can register for a minimum of 5 courses and maximum of 7 courses in each semester of II Year, III Year and IV Year I Semester of study.

5.4 National Cadet Corps (NCC) / National Service Organisation (NSO) / National Service Scheme (NSS) Requirements:

- All candidates admitted to the B.Tech. programme will have to take either NCC or NSO or NSS as an extra-curricular programme.
- The NCC / NSO / NSS programme will be held as announced by the respective Co-ordinator(s).
- The NCC / NSO / NSS requirements should be completed before III Year II Semester.
- Enrollment of NCC / NSO / NSS programme will be initiated from the date of commencement of class work for II Year I Semester.
- NCC / NSO / NSS certificate must be submitted on or before the last instruction day of III Year II Semester, otherwise his / her Semester End Examination results will not be declared.

5.5 MOOCS (Massive Open Online Courses) Requirements:

- Enrollment of MOOCS course will be initiated from the date of commencement of class work for III Year I Semester.
- MOOCS course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.
- List of organisations offering MOOCS course(s) will be announced by the respective Board of Studies at the time of commencement of class work for III Year I Semester.

5.6 Internship / Industrial Training / Certification Course :

- Enrollment of Internship / Industrial Training / Certification Course will be initiated from the end of II Year II Semester.
- Internship / Industrial Training / Certification Course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.

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	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 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 totaling 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%	- 1 mark
Attendance of 80% and above but less than 85%	- 2 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.

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 Semester 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 / Practical Courses. Each theory course is awarded three credits and each practical course is awarded two credits. Project work is awarded eight credits. The total number of credits for all Four years put together shall be 189.

12.2 AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1	≥90	S	10.0
2	≥ 80 - < 90	A	9.0
3	≥ 70 - < 80	B	8.0
4	≥ 60 - < 70	C	7.0
5	≥ 50 - < 60	D	6.0
6	≥ 40 - < 50	E	5.0
7	< 40	F	0.0
8	The grade 'W' represents withdrawal / absent (subsequently changed into pass or E to S or F grade in the same semester)	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 by re-registering it when the course is offered next time.

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

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 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 III Year, if he / she secures a minimum of 70% of the total number of credits of I Year by the time the classwork commences for III Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in II Year II Semester.

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

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

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 II 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 or more but less than 6.5

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 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 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 IV Year II Semester results for those candidates who cleared all courses except one course in IV Year II Semester.

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.

1. A candidate, studied under R-12 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics/attendance at the end of the II Year I Semester, shall join in II Year I Semester of R-16 regulations. The candidate has to clear all the I B.Tech. backlog courses, if any, by appearing the supplementary examinations, conducted by the college under R-12 curriculum. The class will be awarded based on the academic performance of the candidate, such candidates will be considered on par with lateral entry candidates of R-16 regulations and will be governed by regulations applicable to lateral entry candidates' category.

2. A candidate, studied under R-12 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics / attendance at the end of the II Year II Semester and also at the subsequent semesters will follow the same R-12 regulations/curriculum and he/she has to complete all the courses by appearing in the examination conducted by the college under R-12 curriculum. The class will be awarded based on the academic performance of the candidate as per R-12 regulations.

3. A candidate, transferred from other institutions / universities into I Year II Semester and also at the subsequent semesters of B.Tech., shall join at appropriate semester of R-16 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-16 curriculum 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 Honorable 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 Willful 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.

0 - x - 0 - x – 0

R V R & J C COLLEGE OF ENGINEERING, CHOWDAVARAM, GUNTUR-19

(Autonomous)

(w.e.f. the batch of students admitted during the academic year 2016-2017)

CURRICULUM COMPONENTS

Program Curriculum Grouping based on course components

Category of Courses	Curriculum Content (% of total number of credits program)	Subject wise Number of contact hours per week	Total number of credits
Basic Science (BS)	14.81	38	28
Engineering Science (ES)	11.64	34	22
Humanities and Social Science (HS)	8.47	22	16
Program Core (PC)	55.55	151	105
Program Elective (PE)	7.94	20	15
Open Elective (OE)	1.59	4	3
T O T A L number of Credits			189

R V R & J C COLLEGE OF ENGINEERING, CHOWDAVARAM, GUNTUR-19

(Autonomous)

(w.e.f. the batch of students admitted during the academic year 2016-2017)

B.Tech., - EEE I Year I Semester (1st Semester)

S. No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Sem End Exam.(hrs)	Sessional Marks	Semester End Exam. Marks	Credits	
1	EE/EC/ME 101 Differential equations and statistics	3+1		3	40	60	3	BS
2	EE/CE/ChE/CS/EC/IT/ ME 102 Engineering Physics	4	-	3	40	60	3	BS
083	EE/CE/CS/EC/IT/ME 103 Applied Chemistry	4	-	3	40	60	3	BS
4	EE/CE/ME 104 English for communication	4	-	3	40	60	3	HS
5	EE/CE/ME 105 Problem solving with C	4+1	-	3	40	60	3	ES
6	EE 106 Professional Ethics & Human values	4	-	3	40	60	3	HS
7	EE/CE/ME 151 Chemistry Lab	-	3	3	40	60	2	BS
8	EE/CE/ME 152 C- Programming Lab	-	3	3	40	60	2	ES
9	EE 153 Workshop Practice Lab	-	3	3	40	60	2	ES
Total		23+2	9	-	360	540	24	

B.Tech., - EEE 1 Year II Semester (2nd Semester)

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Sem end Exam. (hrs)	Sessional Marks	Semester End Exam. Marks	Credits	
1	EE/EC/ME 107 Calculus and Numerical Methods	3+1	-	3	40	60	3	BS
2	EE/EC/CS/IT 108 Electronic and Electrical Engineering Materials	4	-	3	40	60	3	BS
3	EE/EC/CS/IT/CE/ME 109 Chemistry of Engineering Materials	4	-	3	40	60	3	BS
4	EE/CE/ME 110 Environmental Studies	4	-	3	40	60	3	HS
5	EE 111 Mechanics For Engineers	4+1	-	3	40	60	3	ES
6	EE 112 Introduction to Electrical Engineering	4	-	3	40	60	3	PC
7	EE/CE/ME 154 Physics Lab	-	3	3	40	60	2	BS
8	EE/CE/ME 155 Communication Skills Lab.	-	3	3	40	60	2	HS
9	EE 156 Engineering Graphics Lab	2	4	3	40	60	2	ES
Total		25+2	10	-	360	540	24	

B.Tech., EEE II Year I Semester (3rd Semester)

S. No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester End Exam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	EE/EC 201 Transformation Techniques	4	-	3	40	60	3	BS
2	EE/EC 202 Electronic Devices & Circuits	4	-	3	40	60	3	PC
3	EE/EC 203 Digital Logic Design	4+1	-	3	40	60	3	PC
4	EE 204 Network Theory	4+1	-	3	40	60	3	PC
5	EE 205 DC Machines	4	-	3	40	60	3	PC
6	EE 206* Mechanical Technology	4		3	40	60	3	ES
7	EE 251 Networks & DC machines Lab	-	3	3	40	60	2	PC
8	EE 252 Electronic Devices Lab	-	3	3	40	60	2	PC
9	EE 253 Mechanical Technology Lab	-	3	3	40	60	2	ES
Total		24+2	9	-	360	540	24	

Enrollment of NCC/NSO/NSS will be initiated from the date of commencement of class work for II Year I Semester.

*** Subjects, which are offered in both 1st and 2nd Semesters:**

EE 206: Mechanical Technology
EE 212: Electromagnetic Field Theory

B.Tech., EEE II Year II Semester (4th Semester)

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester End Exam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	EE/EC 207 Complex and Numerical Analysis	4	-	3	40	60	3	BS
2	EE/EC 208 Electronic Circuit Analysis	4	-	3	40	60	3	PC
3	EE 209 Network Analysis & Synthesis	4+1	-	3	40	60	3	PC
4	EE 210 AC Machines	4+1	-	3	40	60	3	PC
5	EE 211 Data Structures using C++	4	-	3	40	60	3	ES
6	EE 212* Electromagnetic Field Theory	4+1	-	3	40	60	3	PC
7	EE 254 AC Machines Lab	-	3	3	40	60	2	PC
8	EE 255 Data Structures Lab	-	3	3	40	60	2	ES
9	EE 256 Professional Communication Skills Lab	-	3	3	40	60	2	HS
Total		24+3	9	-	360	540	24	

- **Internship / Industrial Training / Certification Course:**

Enrollment of Internship / Industrial Training / Certification Course will be initiated from the end of II Year II Semester.

*** Subjects, which are offered in both 1st and 2nd Semesters:**

EE 206: Mechanical Technology

EE 212: Electromagnetic Field Theory

B.Tech., EEE III Year I Semester (5th Semester)

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester End Exam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	EE/EC 301 Pulse and Digital Circuits	4	-	3	40	60	3	PC
2	EE/EC 302 Microprocessors & Microcontrollers	4+1	-	3	40	60	3	PC
3	EE 303 Linear Control Systems	4+1	-	3	40	60	3	PC
4	EE 304 Synchronous & Special Machines	4	-	3	40	60	3	PC
5	EE 305* Generation of Electrical Power	4	-	3	40	60	3	PC
6	EE 306* Transmission & Distribution	4+1	-	3	40	60	3	PC
7	EE 351 Synchronous & Special Machines Lab	-	3	3	40	60	2	PC
8	EE 352 Electronic Circuits Lab	-	3	3	40	60	2	PC
9	EE 353 Microprocessors & Microcontrollers Lab	-	3	3	40	60	2	PC
Total		24+3	9	-	360	540	24	

- Enrollment of MOOCS course will be initiated from the date of commencement of class work for III Year I Semester.

*** Subjects, which are offered in both 1st and 2nd Semesters:**

EE 305 : Generation of Electrical Power
EE 306 : Transmission& Distribution

Elective I:	**EE 311A:** High Voltage Engineering	**EE 311B:** Operations Research
	EE 311C: Digital Signal Processing	**EE 311D:**Power system Deregulation
Elective II:	**EE 312A:**Electrical Machine Design	**EE 312B:**ANN and Fuzzy Systems
	EE 312C: Renewable Energy Resources	**EE 312D:**OrganisationalBehavior

B.Tech., EEE III Year II Semester (6th Semester)

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester End Exam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	EE 307 Linear ICs and Applications	4	-	3	40	60	3	PC
2	EE 308 Power system Analysis & Stability	4+1	-	3	40	60	3	PC
3	EE 309 Power Electronics	4	-	3	40	60	3	PC
4	EE 310 Electrical Measurements & Instrumentation	4+1	-	3	40	60	3	PC
5	EE 311* Elective-I	4	-	3	40	60	3	PE
6	EE 312* Elective-II	4	-	3	40	60	3	PE
7	EE 354Electrical Measurements & Instrumentation Lab	-	3	3	40	60	2	PC
8	EE 355 Control systems Lab	-	3	3	40	60	2	PC
9	EE 356 Electrical Workshop practice Lab	-	3	3	40	60	2	PC
Total		24+2	9	-	360	540	24	

- NCC/NSO/NSS Certificate must be submitted on or before the last instruction day of III Year II Semester otherwise his/her Semester End Examination result will not be declared.

*** Subjects, which are offered in both 1st and 2nd Semesters:**

EE 305 : Generation of Electrical Power
EE 306 : Transmission& Distribution

Elective I:	**EE 311A:** High Voltage Engineering	**EE 311B:** Operations Research
	EE 311C: Digital Signal Processing	**EE 311D:**Power system Deregulation
Elective II:	**EE 312A:**Electrical Machine Design	**EE 312B:**ANN and Fuzzy Systems
	EE 312C: Renewable Energy Resources	**EE 312D:**OrganisationalBehavior

B.Tech., EEE IV Year I Semester (7th Semester)

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Sem EndExam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	EE 401 Switch Gear & Protection	4	-	3	40	60	3	PC
2	EE 402 Computer Applications to Power Systems	4+1	-	3	40	60	3	PC
3	EE 403 MOOCS	-	-	-	-	-	0	OE
4	EE 404 Elective-III (Open Elective)	4	-	3	40	60	3	OE
5	EE405* Industrial Management	4	-	3	40	60	3	HS
6	EE 406* Elective-IV	4	-	3	40	60	3	PE
7	EE 451 Mini project / Term Paper	-	3	3	100	--	2	PC
8	EE 452 Power Electronics Lab	--	3	3	40	60	2	PC
9	EE 453 Power Systems Lab	-	3	3	40	60	2	PC
Total		20+1	9	--	380	480	21	

- MOOCS Certificate must be submitted on or before the last instruction day of IV Year I Semester otherwise his/her Semester End Examination result will not be declared.
- Internship / Industrial Training / Certification Course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.

404 : Elective -III (Open Elective)

CE 404A: Basic Surveying
CH 404A: Energy Engineering
CS 404A: JAVA Programming
EC 404A: Applied Electronics
IT 404A: Software Engineering
ME 404A: Robotics

CE 404B: Building Materials & Estimation
CH404B: Bio- Fuels
CS404B: Database Management systems
EC404B: Basic Communication
IT 404B: Web Technologies
ME 404B: Operations Research

*** Subjects, which are offered in both 1st and 2nd Semesters:**

EE 405: Industrial Management

Elective-IV:	**406A:** Industrial Drives	**406B:** Power Plant Instrumentation
	406C: EHV AC Transmission	**406D:** Energy Conservation & Audit
Elective-V:	**409A:** HVDC Transmission	**409B:** Electrical Distribution Systems
	409C: Embedded Systems & VLSI	**409D:** Smart Grids
Elective-VI:	**410A:** FACTS Controllers	**410B:** Digital Control systems
	410C: Computer Networks	**410D**: Industry Open Slot

B.Tech., EEE IV Year II Semester (8th Semester)

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester End Exam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	EE 407 Utilization of Electric Power	4	-	3	40	60	3	PC
2	EE 408 Power System Operation & Control	4	-	3	40	60	3	PC
3	EE 409* Elective-V	4	-	3	40	60	3	PE
4	EE 410* Elective-VI	4	-	3	40	60	3	PE
5	EE 454 Simulation of Electrical systems lab	-	3	3	40	60	2	PC
6	EE 455 Project Work	-	9	3	40	60	10	PC
Total		16	12	-	360	540	24	

*** Subjects, which are offered in both 1st and 2nd Semesters:**

EE 405: Industrial Management

Elective-IV: **406A:** Industrial Drives **406 B:** Power Plant Instrumentation
406C: EHV AC Transmission **406D:** Energy Conservation & Audit
Elective-V: **409A:** HVDC Transmission **409B:** Electrical Distribution Systems
409C: Embedded Systems & VLSI **409D:** Smart Grids
Elective-VI: **410A:** FACTS Controllers **410B:** Digital Control systems
410C: Computer Networks **410D**: Industry Open Slot

EE/EC/ME – 101	DIFFERENTIAL EQUATIONS AND STATISTICS (common to EEE,ECE&ME)	L	T	P	C
		3	1	--	3

COURSE OBJECTIVES:

1. To provide knowledge on solving ordinary differential equations.
2. To provide knowledge on applications of first order ordinary differential equations.
3. To provide knowledge on solving higher order ordinary differential equations.
4. Focused in partial differential equations.
5. To provide knowledge on curve fitting, correlation and regression lines.

Course outcomes:

Upon completion of this course, students will be able to:

1. Understand methods of solving first order differential equations.
2. Understand some physical applications of first order differential equations.
3. To solve higher order differential equations
4. To solve partial differential equations
5. To understand the relation between two variables by Curve fitting.

Course Content:

UNIT I (Text book-1) (12)

Differential Equations of First Order:

Definition-Formation of differential equation-Equations of first order and first degree: Linear equations, Bernoulli's equation.

Exact differential equations - Equations reducible to exact equations.

UNIT II (Text book-1) (12)

Applications of differential equations of first order: Orthogonal trajectories, Newton's law of cooling, growth and decay problems

Higher order Linear Differential Equations: Definitions–Operator D–Rules for finding the complementary function.

UNIT III (Text book-1) (12)

Inverse operator–Rules for finding Particular Integral–working procedure. Method of variation of parameters.

Equations reducible to linear equations with constant coefficients: Cauchy's and Legendre's Linear equations.

UNIT IV (Text book-1) (12)

Partial Differential Equations:

Formation-Equations solvable by direct integration-Linear equations of first order- Lagrange's linear equation.

Linear Homogeneous partial differential equations of higher order with constant coefficients.

Unit V (Text book-1) (12)

Statistics: Method of least squares - Fitting of straight line and parabola.

Correlation, Co-efficient of correlation (direct method), Lines of regression.

Learning Resources:

Text Book:

1. Dr. B.S. Grewal, Higher Engineering Mathematics,Khanna Publishers, 42nd Edition

Reference Book:

1. Erwin Kreyszig, Advanced Engineering Mathematics.

Web Resources:

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

EE/CE/ChE/CS/IT/EC/ME -102	ENGINEERING PHYSICS	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

i) To impart knowledge and understanding of basic principles of Ultrasound and its applications in imaging and industry

ii) To understand about basic phenomena of light waves.

iii) To understand about fundamentals of Laser, its types and applications. 3-D photography , principle and applications of optical fiber..

iv) To understand Essential formulation of physics in the micro world.

v) To understand development of Electromagnetic wave equations.

COURSE OUTCOMES:

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

1. understand the concepts of Ultrasonic waves, production and applications in NDT.
2. understand the interference in thin films and its application, Concept of diffraction and grating, birefringence and production and detection of different polarized lights.
3. acquire Knowledge on basics of lasers, holography, fibers and their applications.
4. understand Schrodinger wave equation and its applications in 1-D with respect to the domain of quantum world.
5. describe the nature of electromagnetic radiation and matter in terms of the particles

UNIT- I (12 Periods)

Ultrasonics: properties, production of ultrasonics by magnetostriction, piezo electric oscillator methods, detection by acoustic grating method, General applications of ultrasonics in industry and medicine.
NDT: Normal beam pulse echo testing, ultrasonic scanner (A & B modes)

UNIT- II (12 Periods)

Physical Optics : Interference: Introduction, Stoke's principle (change of phase on reflection), interference in thin films due to reflected light (Cosine law), theory of air wedge (fringes produced by a wedge shaped thin film), theory of Newton's rings(reflected system).

Diffraction: Introduction, Fraunhofer diffraction due to a single slit (quantitative), theory of plane transmission diffraction grating.

Polarization: Introduction, double refraction, construction and working of a nicol prism, quarter wave plate, production and detection of circular and elliptical polarizations(qualitative).

UNIT III (12 Periods)

Lasers : Characteristics, spontaneous and stimulated emissions, Einstein coefficients and relation between them, population inversion, pumping, active system, gas (He-Ne) laser,

Nd: YAG laser and semiconductor (GaAs) laser, applications of lasers.

Holography: Basic principle, recording, reproduction and applications.

Fiber optics: Principle & structure of an optical fiber, numerical aperture, acceptance angle and acceptance cone, fractional index change, types of optical fibers, fiber optics in communication system and its advantages, Applications of optical fibers.

UNIT IV (12 Periods)

Principles of Quantum Mechanics : de Broglie's concept of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle-experimental verification (electron diffraction - single slit)

Schrodinger equation and application : Time independent Schrodinger's wave equation, physical significance of the wave function, particle in a box (one dimensional), tunneling effect, expression for transition probability (Qualitative treatment).

UNIT V (12 Periods)

Electromagnetism : Induced electric fields, displacement current and conduction current, Maxwell's equation - qualitative (differential & integral forms) - significance, velocity of electromagnetic wave equation in free space, Poynting Theorem, LC oscillations (quantitative).

LEARNING RESOURCES:

TEXT BOOK(s):

1. M.N.Avadhanulu & P.G. Kshirasagar - Engineering Physics, S.Chand & Co.Ltd.
2. V. Rajendran - Engineering Physics

REFERENCE BOOK(s):

1. Resnick & Halliday - Fundamentals of Physics, John Wiley sons.
2. SL Kakani & Shubhra kakani - Engineering Physics, 3rd Edition, CBS Publications Pvt. Ltd. Delhi.
3. B. K. Pandey & S. Chaturvedi - Engineering Physics, Cengage Learning India Pvt. Ltd., Delhi.
4. Hitendra K. Malik & A.K.Singh - Engineering Physics, TMH, New Delhi.
5. P.K.Palanisamy -Engineering Physics, Scitech Publications.

WEB RESOURCES:

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

Course relevant website : www.rvrjcce.ac.in/moodle/first year/engineering physics-I

EE/CE/CS/IT/EC/ME -103	APPLIED CHEMISTRY	L	T	P	C
		4	--	--	3

Course Objectives :

1. To know the softening methods and quality parameters of water used in industries.
2. To know the requirements and purification methods of drinking water.
3. To understand the construction and functioning of electrochemical energy systems.
4. To study the mechanisms, types, factors influencing corrosion and protection methods of corrosion.
5. To acquire knowledge on latest analytical techniques.

Course Outcomes:

After completion of the course the student will be able to:

1. acquire knowledge on quality and utility of water in industries.
2. gain knowledge on water treatment for drinking purpose.
3. understand functioning of electrochemical energy systems.
4. relate corrosion and environment and suggest methods to prevent corrosion.
5. analyse substances using techniques like Spectrophotometry, Colorimetry, Conductometry and Potentiometry.

COURSE CONTENT:

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

Water technology: Types of Hardness - units and determination by EDTA method (simple problems),Water technology for industrial purpose: Boiler troubles- scales, sludges, caustic Embrittlement, boiler corrosion, priming and foaming - causes and prevention.

Internal conditioning - phosphate, calgon and carbonate treatment. External conditioning-lime soda process (simple problems), softening by ion exchange process. Desalination of brackish water by electro dialysis and reverse osmosis.

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

Water treatment for drinking purpose - WHO guidelines, sedimentation, coagulation, filtration (slow sand filter), various methods of chlorination, breakpoint chlorination.

Phase Rule: Statement and explanation of the terms involved, one component water system, condensed phase rule - construction of phase diagram by thermal analysis, simple eutectic system (Pb-Ag system only), applications eutectic compounds.

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

Electrochemistry: Electrode potential, electrochemical series and its significance, Nernst equation - derivation - related problems, Reference electrodes (SHE and Calomel electrode) Ion-selective electrode - glass electrode and measurement of pH.

Electrochemical Energy Systems: Types of electrochemical energy systems, electrochemistry of primary batteries (Lachlanche or dry cell), Secondary cells (Lead Acid cell, Ni-Cd cell), Lithium batteries (Li-MnO_2 Lithium organic electrolyte) and their advantages. Fuel cells (Oxygen-Hydrogen).

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

Corrosion and its control: Introduction, dry corrosion, electrochemical theory of corrosion, Types of corrosion- differential aeration, galvanic (galvanic series) and Stress corrosion Factors affecting corrosion-design, pH, over voltage and temperature.

Protection methods: Cathodic protection, (Impressed current and sacrificial anode) corrosion inhibitors- types and mechanism of inhibition, metallic coatings - Galvanization, Tinning, Electroplating (Cu) and electro less plating (Ni)

UNIT V *Text Book - 1,2***(12)**

Analytical Techniques: Spectroscopy- Beer-Lambert's law, UV-electronic transitions - chromophores - auxochromes - shifts, and IR- modes of vibrations, ex.H_2O, CO_2 Instrumentation of UV and IR.

Colorimetry - estimation of Iron, Conductometric (HCl vs NaOH) and potentiometric titrations (Fe(II) vs $K_2Cr_2O_7$).

Learning Resources:

Text Books:

1.P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 15th Edition, 2008
2. Shashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai and Co.(P) Ltd., New Delhi, 3rd Edition, 2009,

Reference books:

1. S.S. Dara and S.S. Umare, A Text Book of Engineering Chemistry, S.Chand and Co.Ltd, 12th Edition, 2010,

Web references:

http://www.powerstream.com/BatteryFAQ.html#lec
http://freevideolectures.com/Course/3029/Modern-Instrumental-Methods-of-Analysis
http://www.cdeep.iitb.ac.in/webpage_data/nptel/Core%20Science/Engineering%20Chemistry%201/

EE/CE/ME 104	ENGLISH FOR COMMUNICATION	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

1. Use vocabulary contextually.
2. Compose effectively the various forms of professional communication.
3. Apply grammar rules efficiently in spoken and written forms.
4. Understand and overcome the barriers in communication.
5. Develop professional writing.

Unit – I

Lexis: **[12]**

a. i.Synonyms & Antonyms
   ii. Words often confused
b. i. One Word Substitutes
   ii. Analogies

Unit – II

Written Communication: **[12]**

a. Note-taking & Note-making
b. Writing a Proposal
c. Memo Writing
d. Paragraph writing

Unit – III

Principles of Grammar: **[12]**

Exposure to basics of grammar with emphasis on

a. Articles & Prepositions
b. Tenses
c. Voice
d. Speech

Unit – IV

Communication: **[12]**

Forms of communication– Barriers to communication – Non-verbal Communication - Kinesics, Proxemics, Occulesics, Haptics

Unit – V

Composition: **[12]**

a) E-mail
b) Letter-writing: order, complaint, job application, invitation.
c) Precis writing
d) Biographical writing:
   i. APJ Abdul Kalam ii. Ratan Tata
   iii. Sudha Murthy iv. Mother Teresa

Learning Resources:

Text Books:

1. Technical English - by Dr. M. Sambaiah, Wiley India Pvt. Ltd, New Delhi 2015.
2. *Communication Skills* – OUP, by Sanjay Kumar & Pushpa Latha (This text is prescribed for the topics; (1) One Word Substitutes (2) Note-taking and (3) Haptics.)

Reference Books:

1. *Dictionary of Synonyms and Antonyms*, Oxford & IBH, III Ed
2. *Objective English* III Edition, Mc-Graw Hill Companies- by Hari Mohan Prasad, Uma Rani Sharma.
3. *Technical Communication – Principles & Practice*. II Ed, by Meenakshi Raman & Sangeetha Sharma
4. *Oxford Michael Swan- Practical English Usage* – III Ed . New international Students ' Ed,OUP.
5. *Business Communication* II Ed. Meenakshi Raman & Prakash Singh, OUP.
6. Handouts.
7. *A course in English Communication* – by Kiranmai Dutt, Rajeevan, C.L.N Prakash.
8. The Most Common Mistakes in English Usage – Thomas Elliott Berry.

EE/CE/ME 105	PROBLEM SOLVING WITH C	L	T	P	C
		4	1	--	3

COURSE OBJECTIVES:

1. To understand the basic problem solving process using algorithm, Flow Charts and pseudo-code development.
2. To understand the basic concepts of control structures in C.
3. To understand the concepts of arrays, functions and pointers in C and can effectively use pointers for Dynamic memory allocation.
4. To understand 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 algorithms and flow charts for simple problems.
2. use suitable control structures for developing code in C.
3. design modular programs using the concepts of functions and arrays.
4. design well-structured programs using the concepts of structures and pointers.
5. develop code for complex applications using file handling features.

COURSE CONTENT:

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

Introduction : Computer & it's Components, Hardware , Software, programming languages, Algorithm, Characteristics of algorithm, Flowchart, Symbols used in flowchart, history of C, structure of C program, C language features.

C Tokens: Character set, Identifiers, Keywords, constants, Data types, type qualifiers, Declaration and Initialization of variables.

Operators & Expressions: C operators and expressions, Type-conversion methods, Operators Precedence and Associativity, Input/ Output functions and other library functions.

Programming Exercises: C-Expressions for algebraic expressions, Evaluation of arithmetic and boolean expressions. Values of variables at the end of execution of a program fragment, Computation of values using scientific and engineering formulae.

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

Control Statements : If-Else statement, Else-lf statement, Switch statement and goto statement, Looping- While, Do-While and for statements, Break and continue statements.

Programming Exercises: Finding the largest of three given numbers, Computation of discount on different types of products with different ranges of discount, finding the type of triangle formed by the given sides, Computation of income-tax, Computation of Electricity bill, finding roots of a quadratic equation. Finding the factorial of a given number, test whether a given number is-prime, perfect, palindrome or not, Generation of prime and Fibonacci numbers.

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

Arrays: One – dimensional and Two-dimensional numeric arrays, One – dimensional and Two-dimensional character arrays.

Functions: Function Definition, Function prototype, types of User Defined Functions, Function calling mechanisms, Built-in string handling and character handling functions, recursion, Storage Classes, multi-file compilation, Function with Arrays.

Programming Exercises: Computation of statistical parameters of a list of numbers, sorting and searching a given list of numbers, Operations on Matrices such as addition, multiplication, Transpose of a matrix. Finding whether a given string is palindrome or not, sorting of names, operations on strings with and without using library functions, recursive functions to find the factorial value, Fibonacci series, GCD, swapping of two variables, calling the function by passing arrays.

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

Pointers: Pointer, Accessing a variable through pointer, pointer Arithmetic, pointer and Arrays, Dynamic memory allocation, pointer to pointer, Array of pointers.

Structures: Structures, Nested structures, Array of structures, Pointer to structures, passing structures to functions, self referential structure, Unions.

Programming Exercises: Sort and search the given list using functions and pointers, operations on arrays using functions and pointers. Operations on complex numbers, maintaining the books details by passing array of structures to functions, sorting the list of records.

UNIT-V *Text Book - 1* (12)

Files: Defining and opening a file, closing a file, input/output operations on files using file handling functions, random access to files. Command line arguments, C-preprocessor directives.
Command line arguments, C-preprocessor directives.

Programming Exercises: Create and display the contents of text file, copy the contents of one file into another, merging the contents of two files, writing, reading and updation of student records in a file, programs to display the contents of a file and copy the contents of one file into another using command line arguments.

Learning Resources:

Text Books:

1. Byron Gottfried Programming with C (Schaum's Outlines) Third Edition, Tata Mcgraw-Hill.

Reference Books:

1. Stephen G.Kochan, Programming in C,FourthEdition,Pearson
2. Herbert Sheildt, C- Complete Reference, TMH., 2000
3. K R Venugopal&Sudeep R Prasad, Programming with C, TMH., 1997
4. Brian W.Kernighan& Dennis M.Ritchie, The C programming language, Second Edition, PHI

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 – 106 PROFESSIONAL ETHICS AND HUMAN VALUES

L	T	P	C
4	--	--	3

COURSE OBJECTIVES:

1. To provide essential complementarily between "VALUES" and "SKILLS" to ensure sustained happiness and prosperity.
2. To introduce Ethical concepts that are relevant to resolving Moral issues in Engineering and to impart reasoning and analytical skills needed to apply ethical concepts to Engineering decisions.
3. To facilitate the development of a Holistic perspective towards life, profession and happiness, based on a correct understanding of the Human reality.
4. To understand the need for lifelong learning and have the knowledge and skills that prepare them to identify the moral issues involved in engineering areas
5. To provide an understanding of the interface between Social, Technological and Natural environments.

COURSE OUTCOMES:

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

1. Comprehend a specific set of behaviours and values the professional interpreter must know and must abide by, including confidentiality, honesty and integrity.
2. Strive to achieve the highest quality, effectiveness and dignity in both the process and products of professional work
3. Understand the moral requirements of engineering experiments, and have the ability to apply their knowledge to the solution of practical and useful problems;
4. Understand Lack of communication, prejudice in not asking for clarification, fear of law and plain neglect will lead to the occurrence of many repetitions of past mistakes.
5. Know and respect existing laws pertaining to professional work. The students can speak out against abuses in these areas affecting the public interest.

COURSE CONTENT:

UNIT I Text Books 1&2 (12)

Morals, Values and Ethics - Self-Confidence - Character - Valuing Time - Courage - Honesty - Caring - Sharing-Self respect - Respect for Others - Spirituality - Living Peacefully. Integrity- Commitment - Empathy - Work Ethics - Service Learning - Stress management - Civic Virtue - Co-operation.

UNIT II Text Books 1&2 (12)

Scope and aims of Engineering Ethics - Senses of 'Engineering Ethics'- Variety of Moral Issues - Types of Inquiry - Engineering Ethics and Philosophy.

Moral Dilemmas - Moral Autonomy - Kohlberg's theory - Gilligan's theory - Criteria for a profession - Multiple Motives - Models of Professional Roles.

UNIT III Text Books 1&2 (12)

Moral reasoning and Ethical Theories - Virtue Ethics - Utilitarianism-Duty ethics - Right ethics-Self interest, Customs and Religion - Uses of Ethical Theories-Testing of Ethical Theories.

Engineering as experimentation - Similarities to Standard Experiments - Contrasts with Standard Experiments - Engineers as Responsible Experimenters - A Balanced Outlook on Law - Problems with

Law in engineering - The Challenger Case Study.

UNIT IV **Text Books 1&2** **(12)**

Safety and Risk - Assessment of safety and risk - Risk benefit analysis and reducing risk - Testing for safety The Three Mile Island and Chernobyl case studies and safe exit.

Collegiality and loyalty - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Intellectual property rights (IPR) - Discrimination.

UNIT V **Text Books 1&2** **(12)**

Professional rights - Employee rights - Whistle blowing - discrimination - Multinational corporations - Environmental ethics - Computer ethics - Weapons development.

Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors – Moral leadership - codes of ethics - role and limitations of codes - Sample code of ethics like ASME, ASCE, IEEE, Institution of Engineers (IE), India Indian Institute of Materials Management, Institution of electronic and telecommunication engineers (IETE), India, etc.

Learning Resources:

Text Book(S):

1. Mkie Martin and Roland Schinzinger, Ethics in Engineering, McGraw - Hill, New Jersey, 2004 (Indian Reprint)
2. Govindarajan M, Natarajan S, Senthil Kumar V.S - Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

Reference Book(S):

1. T Charles D. Fleddermann - Engineering Ethics, Pearson Education / Prentice Hall, 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)

Web Resources:

1. http://nptel.ac.in/courses/109104068
2. http://nptel.ac.in/courses/109104030

EE/CE/ME151	CHEMISTRY LAB	L	T	P	C
		--	--	3	2

COURSE OBJECTIVES:

1. To learn the concepts of equivalent weight, molecular weight, normality, molarity, weight percent, volume percent.
2. To prepare molar solutions of different compounds.
3. To know the methods of determining alkalinity, hardness and chloride ion content of water sample.
4. To know the methods to determining purity of washing soda, percentage of available chlorine in bleaching powder.
5. To learn the redox methods to determine Fe2+ ions present in solution.
6. To know principles and methods involved in using instruments like conductivity bridge, spectrophotometer, pH meter and potentiometer

COURSE OUTCOMES:

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

1. Acquire knowledge on normality, molarity, molecular weight, equivalent weight, oxidizing agent, reducing agent.
2. Prepare solutions with different concentrations.
3. Analyze water for its hardness, alkalinity, chloride ion content, iron content.
4. Understand the principles behind the development of instruments suitable for chemical analysis.

Later he can use the knowledge in modifying instruments.

List of Experiments:

1. Determination of total alkalinity of water sample
a. Standardization of HCl solution b. Determination of alkalinity of water
2. Determination of purity of washing soda
a. Standardization of HCl solution b. Determination of percentage purity of washing soda
3. Estimation of Chlorides in water sample
a. Standardization of $AgNO_3$ solution b. Estimation of Chlorides in water
4. Determination of Total Hardness of water sample
a. Standardization of EDTA solution b. Determination of Total Hardness of water
5. Estimation of Mohr's salt - Permanganometry
a. Standardization of $KMnO_4$ solution b. Estimation of Mohr's salt
6. Estimation of Mohr's salt - Dichrometry
a. Standardization of $K_2Cr_2O_7$ solution b. Estimation of Mohr's salt
7. Determination of available chlorine in bleaching powder
a. Standardization of Hypo b. Determination of available chlorine in bleaching powder
8. Estimation of Magnesium
a. Standardization of EDTA solution b. Estimation of Magnesium
9. Conductometric titration of an acid vs base
10. Potentiometric titrations: Ferrous Salt vs Dichromate

Demonstration Experiments:

11. pH metric titrations of an acid vs base
12. Spectrophotometry: Estimation of Mn/Fe

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

Learning Resources:

Text Books:

1. Engineering Chemistry, P.C. Jain and Monika Jain, 15th Edition, 2008, Dhanpat Rai Publishing Company, New Delhi.
2. A Text Book of Engineering Chemistry, Shashi Chawla, 3rd Edition, 2009, Dhanpat Rai and Co.(P) Ltd., New Delhi.

EE/CE/ME 152	C - PROGRAMMING LAB	L	T	P	C
		--	--	3	2

COURSE OBJECTIVES:

1. To understand the ANSI C/Turbo C compilers.
2. To develop various menu driven programs using conditional and control flow statements.
3. To develop programs using structures, unions and files.
4. To develop 'C' programs for various applications.

COURSE OUTCOMES:

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

1. develop various menu driven programs like generation of electricity bill, evaluation of series etc.
2. write C programs using 1D, 2D and Multi Dimensional arrays.
3. write C programs to develop various applications using structures, unions and Files.
4. develop 'C' programs for various applications.

List of Experiments:

1. Write a program for electricity bill taking different categories of users, different slabs in each category. (Using nested if else statement or Switch statement).

Domestic level consumption as follows	
Consumption units	Rate of charges(Rs.)
0-200	0.50 per unit
201-400	100 plus 0.65 per unit
401-600	230 plus 0.80 per unit
601 and above	390 plus 1.00 per unit
Street level consumption as follows	
Consumption units	Rate of charges(Rs.)
0-100	0.50 per unit
101-200	50 plus 0.60 per unit
201-300	100 plus 0.70 per unit
301 and above	200 plus 1.00 per unit

2. Write a C program to evaluate the following (using loops):
   (i) $x-x^3/3!+x^5/5!-x^7/7!+$----------up to n terms
   (ii) $1+x+x^2/2!+x^3/3!+$----------up to n terms
   (iii) $1-x^2/2!+x^4/4!-x^6/6!+$----------up to n terms
3. Write a menu driven program to test whether a given number is (using Loops):
   (i) Prime or not (ii) Perfect or not (iii) Armstrong or not (iv) Strong or not (v) Palindrome or not
4. Write a menu driven program to display statistical parameters (using one - dimensional array)
   (i) Mean (ii) Median (iii) Mode (iv) Standard deviation
5. Write a menu driven program to perform the following operations in a list (using one -Dimensional array)
   (i) Insertion of an element (ii) Deletion of an element (iii) Remove duplicates from the list
   (v) Print the list
6. Write a menu driven program with options (using two dimensional array)

(i) To compute A+B (ii) To compute A x B (iii) To find transpose of matrix A
Where A and B are matrices.

7. Write C programs to perform the following using Strings
(i) To test the given string is palindrome or not (ii) To sort strings in alphabetical order

8. Write C programs using recursive functions
(i) To find the Factorial value (ii) To generate Fibonacci series
(iii) To find the GCD of two given numbers

9. Write a menu driven program with options (using dynamic memory allocation)
(i) Linear search (ii) Binary search

10. Write a menu driven program with options (using Character array of pointers)
(i) To insert a student name (ii) To delete a name (iii) To print list of names
(iv) To sort names in alphabetical order

11. Write a program to perform the following operations on Complex numbers (using Structures & pointers):
(i) Read a Complex number (ii) Addition, subtraction and multiplication of two complex numbers
(iii) Display a Complex number

12. Write C programs to perform the following operations on files
(i) Merging the contents of two files (ii) Writing, reading and updation of student records in a file
(iii) Copy the contents of one file into another using command line argument.

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 153	WORKSHOP PRACTICE LAB	L	T	P	C
		--	--	3	2

Course Objectives:

1. To provide the students hands on experience to make different joints in carpentry with hand tools like jack plane, various chisels & handsaws
2. To provide the students hands on experience to make different joints in welding with tools & equipment like electric arc welding machine,
3. TIG Welding Machine, MIG Welding Machine, hack saws, chipping tools etc.
4. To provide the students hands on experience to make different joints in Sheet metal work with hand tools like snips, stacks, nylon mallets etc.
5. To provide the students hands on experience to make different connections in house wiring with hand tools like cutting pliers, tester, lamps& lamp holders etc .

Course Outcomes:

1. To familiarize with_ The Basics of tools and equipment used in Carpentry, Tin Smithy, Welding and House Wiring.
2. The production of simple models in the above four trades

LIST OF EXPERIMENTS:

Minimum three experiments should be conducted from each trade

1. CARPENTRY

To make the following jobs with hand tools

(a) Lap joint (b) Lap Tee joint (c) Dove tail joint (d) Mortise &Tenon joint (e) Cross-Lap joint

2. **WELDING USING ELECTRIC ARC WELDING PROCESS / GAS WELDING.**

The following joints to be welded.

(a) Lap joint (b) Tee joint (c) Edge joint (d) Butt joint (e) Corner joint

3. **SHEET METAL OPERATIONS WITH HAND TOOLS.**

(a) Rectangular Tray (b) Triangular Tray (c) Pipe Joint (d) Funnel (e) Rectangular Scoop

4. **HOUSE WIRING**

(a) To connect one lamp with one switch (b) To connect two lamps with one switch
(c) To connect a fluorescent tube (d) Stair case wiring (e) Go down wiring

REFERENCE BOOKS:

1. Kannaiah P. &Narayana K. C., "Manual on Work Shop Practice", Scitech Publications, Chennai,1999.
2. Workshop Lab Manual , R.V.R. & J.C. College of Engineering , Guntur

EC/EE/ME 107	CALCULUS AND NUMERICAL METHODS	L	T	P	C
		3	1	--	3

COURSE OBJECTIVES:

1. Finding the Eigen values and Eigen vectors and inverse of a matrix and getting familiarity with diagonalization and quadratic forms.
2. To give basic knowledge on evaluation of double, triple integrals, area and volume.
3. To provide sufficient theoretical and analytical background of differentiation and integration of vector functions.
4. To provide basic knowledge of numerical methods including solving systems of linear equations.
5. To provide knowledge on numerical differentiation and integration.

COURSE OUTCOMES:

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

1. understand the basic linear algebraic concepts.
2. evaluate double, triple integrals and the area, volume by double & triple integrals respectively.
3. solve gradient, divergence, curl and integration of vector function problems.
4. solve system of equations.
5. evaluate derivatives and integrals using numerical techniques.

COURSE CONTENT:

UNIT I **Text Book – 1 (12)**

Matrices: Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of Eigen values (without proofs) - Cayley - Hamilton theorem (without proof). Reduction to diagonal form.
Reduction to diagonal form. Reduction of quadratic form to canonical form by orthogonal transformations, Nature of a quadratic form.

UNIT II **Text Book – 1 (12)**

Multiple Integrals: Double integration in Cartesian and polar coordinates - Change of order of integration - Area as a double integral.
Triple integration in Cartesian coordinates - Change of variables in double integrals from Cartesian to polar - Volume as a Triple Integral.

UNIT III **Text Book – 1 (12)**

Vector Calculus: Gradient, Directional derivatives, divergence, curl - Solenoidal and irrotational fields -Vector identities (without proof).
Line, surface and volume integrals - Green's theorem in the plane, Stoke's theorem and Gauss divergence theorem (without proofs).

UNIT IV **Text Book – 1 (12)**

Numerical Solution of Equations and Interpolation

Newton - Raphson method – Gauss Seidel method. Forward and backward differences – Differences of a polynomial.
Interpolation – Newton-Gregory Forward and Backward Interpolation formulae (without proof), Lagrange's Interpolation formula (without proof) – Inverse interpolation.

UNIT V **Text Book – 1 (12)**

Numerical differentiation and Integration: Newton's forward and backward differences formulae to compute first and second order derivatives.
Trapezoidal rule - Simpson's one third rule.

Learning Resources:

Text Book:
1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

Reference Book:
1. Advanced Engineering Mathematics by Erwin Kreyszig.

Web Resources:

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

EE/EC/CS/IT 108	ELECTRONIC AND ELECTRICAL ENGINEERING MATERIALS	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

1. To understand the concept of electron motion in a periodic potential and classification of solids through bands and intrinsic and extrinsic semiconductors and their carrier densities.
2. To understanding Energy level diagrams in in PN junction, its characteristic equation and the related optoelectronic devices.
3. To understand Basics of Dielectrics and magnetism, Classification of materials on Polarization and Magnetization and applications.
4. To understand Properties and applications of super conductors
5. To understand Nano materials and characterization with X-rays and electron probe techniques.

COURSE OUTCOMES:

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

1. understand the nature of formation of bands in solid and classifying the solids , Importance of Fermi level and law of mass action in semiconductors.
2. understand theory of P-N junction and the devices.
3. acquire knowledge on Importance of polarization and magnetization phenomena and their applications.
4. acquire knowledge on Relevance of superconductivity and its applications.
5. acquire knowledge on Nano material and their characterization principles.

UNIT I **(12)**

Electron theory of solids: Failures of Classical free electron theory and quantum free electron theory (qualitative), Bloch theorem (Qualitative), Kronig-Penney model (Qualitative treatment), effective mass of electron, energy band formation in solids, Classification of solids into metals, semiconductors and insulators.

Semiconductor Physics: Intrinsic & extrinsic semiconductors, density of states, derivation for intrinsic carrier concentration, Hall effect and its uses, direct & indirect band gap semiconductors, donor and acceptor energy levels, charge neutrality, law of mass action.

UNIT II **(12)**

Physics of Semiconductor materials: Drift and Diffusion current, Einstein equation, Formation of P-N junction, energy level diagram and built in potential, Diode equation, I-V Characteristics of P-N junction diode, Photodiode, LED, LCD, solar cell (qualitative).

UNIT III **(12)**

Magnetic Materials: Introduction, origin of magnetic moment, Bohr Magneton, Langevin's theory of paramagnetism, Hysteresis curve, soft and hard magnetic materials, Ferrites and their applications.

Dielectric Materials: Fundamental definitions: Electric dipole moment, polarization vector, polarizability, electric displacement, dielectric constant and electric susceptibility. Types of polarizations - Electric and ionic polarisations, internal fields in solids (Lorentz method), Clausius-Mossotti equation, Frequency dependence of polarization, Ferroelectrics and their applications.

UNIT IV **(12)**

Superconducting materials: Introduction, critical parameters (Tc, Hc, Ic), Meissner effect, types of superconductors, entropy, specific heat, energy gap, BCS Theory(in brief), Josephson effect, London equation and penetration depth, high temperature superconductors, applications of superconductors.

UNIT V **(12)**

Nanomaterials: Introduction to nano materials, surface to volume ratio, General properties of nano materials in brief, fabrication of nano materials (sol-gel and chemical vapour deposition methods), applications of nano materials.

Characterization techniques: SEM, AFM

LEARNING RESOURCES:

TEXT BOOK(s):

1. V. Rajendran - Engineering Physics
2. M.N.Avadhanulu & P.G. Kshirasagar - Engineering Physics, S.Chand & Co.Ltd.
3. P.K.Palanisamy -Engineering Physics, Scitech Publications

REFERENCE BOOK(s):

1. M. Vijaya and G. Rangarajan - Materials science, McGraw Hill Education, 2014.
2. S.O. Pillai - Solid State physics
3. R.K.Puri and V.K.Bubber - Solid state physics and Electronics

WEB RESOURCES:

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

Course relevant website : www.rvrjcce.ac.in/moodle/first year/engineering physics-I

EE/CE/EC/ME/CS/IT 109	CHEMISTRY OF ENGINEERING MATERIALS	L	T	P	C
		4	--	--	3

Course Objectives:

1. To acquire knowledge on formation of polymers and conditions to act as conducting polymers.
2. To gain knowledge on the chemistry of some important plastics and rubbers commonly used.
3. To understand parameters related to efficiency of various fuels
4. To gain knowledge on the characteristics of refractories and lubricants.
5. To understand the requirements and chemistry of explosives and utility of liquid crystals

Course Outcomes:

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

1. know the formation of polymers and the utility of conducting polymers in electronics, electrical and other fields.
2. know usage of plastics and elastomers in day-to-day life and in fields like automobile, electronics, etc.
3. acquire knowledge on composition, quality and uses of various fuels.
4. be capable of selecting appropriate lubricant for a given system, and know the characteristics and utility of refractories.
5. acquire knowledge on the requirements, applications of liquid crystals and explosives.

COURSE CONTENT:

UNIT- I (Text book-1 & 2) (12)

Polymers:

Monomer functionality, degree of polymerization, Tacticity, classification of polymerization- addition, condensation and co-polymerization, mechanism of free radical polymerization.

Conducting polymers: Introduction, examples and applications, Polyacetylene- mechanism of conduction.

UNIT-II (Textbook-1)(12)

Plastics- Thermoplastic and thermosetting resins, preparation, properties and uses of Bakelite, polyesters, Teflon and PVC. Compounding of plastics.

Rubber- Processing of latex, Drawbacks of natural rubber- Vulcanization, Chemistry of Synthetic rubbers- Buna-S and Buna-N, polyurethane rubber and silicone rubber, epoxy resin (adhesive)

UNIT-III (Text book-1) (12)

Fuels: Classification of fuels, calorific value- LCV and HCV-units and determination by Bomb calorimeter, Coal- Ranking, proximate and ultimate analysis, carbonization of coal-types (using Beehive oven), Metallurgical coke-properties and uses.

Petroleum based: Fractional distillation, cracking-fixed bed, reforming, octane number and cetane number of liquid fuels, composition and uses of petrol, diesel**,** CNG and LPG.

UNIT-IV (Text book-1 & 2) (12)

Refractories: Characteristics, classification, properties and their significance–refractoriness, strength of

refractoriness under load, dimensional stability, thermal spalling, thermal expansion, thermal conductivity, porosity Common refractory bricks- silica, fire clay and carborundum.
Lubricants: Classification, functions, properties of lubricants- Viscosity, Viscosity index, Flash point, Fire point, Cloud point, Pour point, Oilyness. Solid lubricants –Graphite and Molybdenum sulphide, Additives, determination of viscosity by Red wood viscometer

UNIT-V **(**Text Book-1) (12)
Liquid crystals: Structure of liquid crystal forming compounds, Classification and applications.

Explosives: Characteristics, terms related to explosives, classification-primary, low and high explosives. Manufacture of gun powder, lead azide, nitroglycerine and RDX

Learning Resources:
Text books:
1.P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi15th Edition, 2008.
2. Shashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai and Co.(P) Ltd., New Delhi, 3rd Edition, 2009.

Reference books:
1. S.S. Dara and S.S. Umare, A Text Book of Engineering Chemistry, S.Chand and Co.Ltd., 12th Edition, 2010.
2. P.Bahadur and N.V. Sastry, Principles of Polymer Science, Narora Publishing House

Web Rwsources:
1. http://www.chem1.com/acad/webtext/states/polymers.html
2. http://www.nptel.ac.in/courses/104105039/
3. http://freevideolectures.com/Course/3070/Science-and-Technology-of-Polymers

EE/CE/ME 110	ENVIRONMENTAL STUDIES	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

1. To give a comprehensive insight into natural resources, ecosystems and bio diversity.
2. To create an awareness on various aspects of environmental pollution and effects.
3. To educate the ways and means to protect the environment from pollution.
4. To impart fundamental knowledge on human welfare and environmental acts.
5. To demonstrate the environmental problems like global warming, ozone layer depletion, acid rains.

COURSE OUTCOMES:

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

1. define and explain the basic issues concerning the ability of the human community to interact in a sustainable way with the environment.
2. describe and discuss the environmental implications of biologically important materials through the ecosystems.
3. describe and discuss the environmental pollution implications and watershed management.
4. discuss the benefits of sustaining each of the following resources - food, health, habitats, energy, water, air, soil and minerals.
5. understand the causes, effects and controlling measures of different types of environmental pollutions with some case studies.

COURSE CONTENT:

UNIT I (Text book-1 & 2) **(12)**

Introduction: Definition, Multidisciplinary nature, Scope and Importance of environmental studies Natural Resources: Forest Resources: Use and over-exploitation, Deforestation, Effects of Mining and Big dams on forests and tribal people.
Water Resources: Use and over-utilization of surface and groundwater, floods and droughts, Water logging and salinity; Conflicts over water. **Energy resources:** Renewable and non-renewable Energy sources; Land as a resource, land degradation, Soil erosion & Desertification.

UNIT II (Text book-1 & 2) **(12)**

Ecosystems: Definition, Structure and functions of Ecosystems, a general account of types of ecosystems with examples. Bio-geo chemical cycles (water, carbon, and nitrogen). **Biodiversity and its Conservation:** Definition of Biodiversity, Values and threats to biodiversity and conservation of biodiversity. Bio-geographical classification of India, India as a mega-diversity nation, Hot-spots of biodiversity, IUCN classification of Biodiversity; Endemic, Exotic and Endangered species - Meaning with a few examples from India.

UNIT III (Text book-1 & 2) **(12)**

Environmental Pollution: Causes, effects and control measures of Air pollution including Noise, Fresh Water pollution, Marine pollution, Thermal pollution, and nuclear pollution. Solid wastes - Types based on source (Ex. municipal, industrial, constructional and medical) and nature (degradable and non-degradable); Effects of improper dumping. Solid waste management - Objectives, practices.

Water shed and its management: Definition and importance; Water shed management methods including rain water harvestment.

UNIT IV (Text book-1 & 2) **(12)**

Social Issues and Environment: Definition of sustainable development, key types and measures for sustainable development; salient features of Stockholm conference 1972, Earth summit, 1992; Human Population and environment, Green revolution, Resettlement and rehabilitation of people - problems and concerns.
Climate Changes: Green House Gases, Kyoto Protocol, Global warming (The story of Tuvalu); Ozone depletion and Acid rain; Environmental Impact Assessment.

UNIT V (Text book-1 & 2) **(12)**

Environmental acts: Environmental Legislation; Wild life protection act, 1972; Water(Prevention and Control of pollution) act, 1974; Forest Conservation act, 1980; Air (Prevention and Control of pollution) act, 1981; Environmental protection act, 1986.
Case Studies: Chipko movement, Narmada BachaoAndolan, Silent Valley Project, Chernobyl Nuclear Disaster, Bhopal Tragedy, Ralegaon Siddhi, The story of Ganga.
Field work:
Visit to a local area to document environmental assets - river / forest / grassland / hill / mountain.
Study of local environment-common plants, insects, birds.
Study of simple ecosystems - pond,river, hill, slopes etc.
Visits to industries, water treatment plants, and effluent treatment plants.

LEARNING RESOURCES:

TEXT BOOK(s):

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.

REFERENCE BOOK(s):

1. T Benny Joseph - Environmental Studies, Tata McGraw-Hill Publishing Company Limited, 2006.
2. G. Tyler Miller Jr. - Environmental Science, 3rd edition, CENGAGE Learning, New Delhi, 2011.

Web Resources:
http://nptel.ac.in/courses/120108004/
http://www.nptel.ac.in/courses/122102006/

EE 111	MECHANICS FOR ENGINEERS (EE)	L	T	P	C
		4	1	--	3

Course Objectives:

1. Learn and understanding the basic principles of mechanics of rigid bodies, various types of force systems and to analyze problems in a simple and logical manner.
2. Study and determine centroids and centre of gravity of various standard geometrical shapes as well as composite areas and bodies.
3. Learn basic concepts of dry friction on inclined planes and wedges.
4. Learn the concept of moment of inertia and the mathematical calculations involved in finding moments of inertia of two dimensional areas.
5. Learn principles of dynamics and understanding the kinematics and kinetics of rectilinear and curvilinear translation of a particle.
6. Study the concept of mass moment of inertia and the mathematical calculations involved in finding moments of inertia of material bodies.
7. Study the kinematics and kinetics of rotation of a rigid body about a fixed axis.

Course Outcomes:

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

1. Apply the principles of mechanics to determine the resultant of several concurrent forces acting on a particle, unknown forces and moments acting on a rigid body.
2. Determine the centriods and center of gravity of standard shapes and composite areas. Apply the basic concepts of dry friction on inclined planes and wedges.
3. Calculate the moment of inertia of various standard sections by method integration and moment of inertia of composite areas.
4. Determine velocity and acceleration of particles under rectilinear and curvilinear translation.
5. Apply dynamic equilibrium equations for analyzing the rigid bodies under rectilinear and curvilinear translation. Apply equations of motion for analyzing the rigid body rotating about a fixed axis.

Course Content:

UNIT – I (Text book-1&2) (14)

Concurrent Forces in a Plane: Principles of statics, composition and resolution of forces, equilibrium of concurrent forces in a plane, method of projections, Method of moments.
Non Concurrent Forces in a Plane: Couple, equilibrium of parallel forces in a plane, resultant and equilibrium of general case of forces in a plane, plane trusses-method of joints.

UNIT – II (Text book-1&2) (14)

Centroid and Centre of Gravity: Concept of centroid and centre of gravity, Centroids of simple figures from basic principles, centroids of composite plane figures
Friction: Types of friction, laws of friction, simple contact friction, wedge friction.

UNIT – III (Text book-1&2) (14)

Moment of Inertia of Plane Figures: Moment of inertia of a plane figure with respect to an axis in its plane, polar moment of inertia, parallel axis theorem, moment of inertia of standard sections by integration, Moment of inertia of composite areas.

UNIT – IV (Text book-1&2) (14)

Rectilinear Motion: Kinematics of rectilinear motion, D'Alemberts principle, work and energy, impulse and momentum, direct central impact.

Curvilinear Motion: Kinematics of curvilinear motion, D'Alembert's principle in curvilinear motion.

UNIT-V (Text book-1&2) (14)

Moment of Inertia of Material Bodies: Moment of inertia of a rigid body, Moment of inertia of a lamina, Moments of inertia of three – dimensional bodies (sphere, right circular cone and cylinder).

Rotation of a Rigid Body about a Fixed Axis: Kinematics of rotation, Equation of motion for a rigid body rotating about a fixed axis.

Learning Resources:

Text Books:

1. S. Timoshenko, D. H. Young, J V Rao and SukumarPati, Engineering mechanics McGraw Hill Education (India) Private Limited, 5th edition (For concepts).
2. A. K. Tayal, Engineering mechanics-statics and dynamics, Umesh publications, 14th edition, (For numerical problems)

Reference Books:

1. S.S.Bhavikatti, Engineering Mechanics 4th edition, New Age international Publishers
2. K.Vijaya Kumar Reddy and J Suresh Kumar, Singer's Engineering Mechanics: Statics and Dynamics3rd Edition SI Units- BSP Books Pvt. Ltd. Publications.
3. J. L. Meriam and L. Kraige A textbook of Engineering mechanics statics and dynamics

Web Resources:

1. http://www.nptel.ac.in/courses/

EE 112	INTRODUCTION TO ELECTRICAL ENGINEERING	L	T	P	C
		4	--	--	3

Course Objectives:

1. To introduce fundamental laws, basic electrical elements, sources and their characteristics.
2. To learn the concept of phase and phase relationship of basic electrical elements, resonance.
3. To impart the basic knowledge about the Magnetic circuits and capacitors

Course Outcomes:

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

1. Understand the basic electrical circuits
2. Basic knowledge about the Magnetic circuits
3. Basic knowledge about the capacitors
4. Gain knowledge about phase and phase relationship of basic electrical elements
5. Gain knowledge about resonance.

COURSE CONTENT:

UNIT – I (Text Book 1&2) (12)

Electric Current - Ohm's Law - Resistance:

Introduction, Electric current, Electric Potential difference, Concept of EMF and potential difference, power, energy, Ohm's law, Resistance, Law of Resistance, Conductance-Conductivity, Effect of Temperature on Resistance , Temperature coefficient of Resistance.

Resistance in series, parallel and series parallel combinations, voltage and current division, Kirchhoff's voltage law and Kirchhoff's current law (Simple problems)

UNIT – II

Magnetic circuits: (Text Book1) (12)

Introduction, Magnetic field, Magnetic flux, Magnetic flux density, Magnetizing force, Absolute and relative permeability, Relation between B and H, B H curve, Magnetic circuit, Comparison between magnetic and electric circuits, Magnetic Hysteresis, Importance of Hysteresis Loop.

Faraday's Laws of Electromagnetic Induction, Lenz law, Dynamically induced EMF, Statically induced EMF, Self Inductance, Mutual Inductance, Coefficient of coupling, Inductances in Series, Inductances in parallel, Energy stored in a magnetic field.

UNIT – III

Capacitance and Capacitors: (Text Book1) (12)

Capacitor, how does a capacitor store charge? Capacitance, Factors affecting capacitance, Dielectric constant or relative permittivity, Capacitance of Isolated Conducting Sphere, Capacitance of Isolated spherical capacitor, Capacitance of Parallel Plate capacitor with uniform Medium, Parallel Plate capacitor with composite Medium, Special cases of Parallel Plate capacitor, multi-plate capacitor, Cylindrical capacitor, Potential gradient in a Cylindrical capacitor.

Capacitors in series, Capacitors in Parallel, Energy stored in a capacitor, charging of capacitor, Time constant, Discharging of a capacitor.

UNIT – IV

Alternating currents and voltages: (Text Book1&2) (12)

Sinusoidal Alternating currents and voltages, Advantages of Sine waveform, Instantaneous, peak, average and RMS values, crest factor, form factor of Sinusoidal waveform; concept of phase and phase

difference in sinusoidal waveforms, Phase relation between voltage & current in pure resistor, inductor and capacitor; concept of reactance, impedance diagram, phasor diagram.

Series and parallel circuits, compound circuits, impedance & admittance. Computation of active, reactive and complex powers, power factor.

UNIT – V **(**Text Book1&2**)** (12)

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.

Learning resources:

Text books:

1. V.K Mehta, “Principles of Electrical Engineering” S.Chand Publications, 7th Edition, 2012.
2. B.L.Theraja, “A text book of Electrical Technology (Volume-1)” S.Chand Publications, 23rdEdition, 2006.

Reference books:

1. A Sudhakar and Shyam Mohan SP, “Circuits and Networks: Analysis and Synthesis”, TMH, 5th Edition, 2015.
2. M.E.Vanvalkenburg, “Network Analysis”, PHI, 3rd Edition, 2006.
3. Franklin F.Kuo, "Network Analysis and Synthesis", Second Edition, John Wiley & Sons, 2009.
4. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuit Analysis”, TMH, 8thEdition, 2012.

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/CE/ME154	PHYSICS LAB	L	T	P	C
		--	--	3	2

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 student will be able to:

1. Use CRO, signal generator, spectrometer for making measurements.
2. Test the optical components using principles of interference & diffraction.
3. Determine the selectivity parameter in electrical circuits.

List of Experiments:

1. Interference fringes - measurement of thickness of a foil using wedge method.
2. Newton's rings - measurement of radius of curvature of Plano - convex lens.
3. Lissajous' figures - calibration of an audio oscillator.
4. Photo cell - characteristic curves and determination of stopping potential.
5. Diffrraction grating - measurement of wavelengths.
6. Torsional pendulum - determination of Rigidity modulus of a wire.
7. Photo-Voltaic cell - determination of fill factor.
8. Series LCR resonance circuit -determination of Q factor.
9. Sonometer - determination of A.C. frequency.
10. Laser - determination of single slit diffraction.
11. B - H Curve - Variation of magnetic field along the axis of a circular current carrying coil.
12. Optical Fiber - Determination of Numerical Aperture and Acceptance Angle.

Reference Book: Physics Lab Manual, R.V.R. & J.C. CE, Guntur

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 155	COMMUNICATION SKILLS LAB	L	T	P	C
		--	--	3	2

Course Objectives:

1. To acquaint the students with the standard English pronunciation, i.e., Received Pronunciation (RP), with the knowledge of stress and intonation.
2. To develop the art of effective reading and answer comprehension passages.
3. To enable the students use phrasal verbs and idiomatic expressions in an apt manner.
4. To equip with appropriate and spontaneous speech dynamics.
5. To develop production and process of language useful for social and professional life.

Course Outcomes:

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

1. know the IPA phonetics symbols, and their relation to pronunciation; recognize the difference among the native, regional and neutral accent of English.
2. employ different skills, inferring lexical and contextual meaning and attempt comprehension passages.
3. use confidently phrases and idioms for effective communication.
4. develop appropriate speech dynamics in professional situations.
5. focus on communication skills and social graces necessary for effective communication.

List of Exercises / Activities:

1. **Phonetics :**
   (i) Sounds, Symbols, Stress and Intonation.
   (ii) Pronunciation - Mother tongue influence - Indianisms etc.

2. **Reading Comprehension :**
   Strategies, Reading skills - Skimming and Scanning, Intensive and Extensive reading.

3. **Idioms &Phrases:** Idioms of variety.

4. **Interactive classroom activities.**
   Jam - (Guided & Free) - Extempore - Elocution - Telephonic Skills.
   Articulation and flow of oral presentation - voice modulation - content generation - Key Word Approach (KWA).

5. **Communication Skills**
   Greeting and Introducing; Making Requests; Agreeing and disagreeing; Asking for and giving permissions; Offering help; Art of small talk; making a short formal speech; Describing people, places, events & things.

Reference Book(S) :

1. A Course in Listening & Speaking II, Foundation books by G.Raja Gopal,2012(For Exercises 1 & 4)
2. Books on GRE, IELTS & TOEFEL (For Exercises 2)
3. English Idioms by Jennifer Seidl W. Mc Mordie, OUP, V Edition , 2009 (For Exercise 3)
4. Interactive classroom activities. (10 titles -CUP) (Unit-IV) (For Exercise 4)
5. A course in English Communication - by Kiranmai Dutt, Rajeevan,C.L.N Prakash, 2013. (For Exercise 5)
6. Better English Pronunciation- J.D.O'Connor, Second Edition, 2009, Cambridge Semester Press, 2012. (For Exercise 1)

Software:

1. Pronunciation power I & II
2. Author plus - Clarity.
3. Call Centre Communication - Clarity.

EE**156**	**ENGINEERING GRAPHICS LAB**	**L**	**T**	**P**	**C**
		2	**--**	**4**	**2**

COURSE OBJECTIVES:

1. Comprehend general projection theory with emphasis on orthographic projection to represent three dimensional objects in two dimensional views.
2. To be able to plan and prepare neat orthographic drawings of points, Straight lines, Regular planes and solids
3. Draw and identify various types of section and Auxiliary views.
4. To enable the students the aspects of development of surfaces in sheet metal working
5. Introduce Auto CAD software for the creation of basic entities and usage of different tool bars.

Course Outcomes:

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

1. acquire basic skills in Technical graphic communication
2. visualize and communicate with 2D as well as three dimensional shapes.
3. understands the application of Industry standards and best practices applied in Engineering Graphics
4. apply the knowledge of development of surfaces in real life situations
5. draw simple 2D Engineering Drawings using Auto CAD.

List of Experiments:

Practice with mini Drafter on Drawing sheets:

General: Use of Drawing instruments, Lettering -Single stroke letters, Dimensioning- Representation of various type lines, Geometrical Constructions, Representative fraction.

Conic sections: general construction and special methods for ellipse, parabola and hyperbola.

Cycloidal curves: cycloid, epicycloid and hypocycloid; involute of circle, and Archemedian spiral.

Method of Projections: Principles of projection - First angle and third angle projection of points. Projection of straight lines. Traces of lines.

Projections of Planes: Projections of planes, projections on auxiliary planes.

Projections of Solids: Projections of Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions.

Sections Of Solids: Sections of Cubes, Prisms, Pyramids, cylinders , and Cones. true shapes of sections. (Limited to the Section Planes perpendicular to one of the Principal Planes).

Development of Surfaces: Lateral development of cut sections of Cubes, Prisms, Pyramids, Cylinders and Cones.

Isometric Projections: Isometric Projection and conversion of Orthographic Projections into isometricviews. (Treatment is limited to simple objects only).

Orthographic Projections: Conversion of pictorial views into Orthographic views. (Treatment is

limited to simple castings).

Computer Aided Drafting (Using any standard package) (Demonstration only) :

Setting up a drawing: starting, main menu (New, Open, Save, Save As etc.), Opening screen, error correction on screen, units, co-ordinate system, limits, grid, snap, ortho

Tool bars: Draw tool bar, object snap tool bar, modify tool bar, dimension tool Bar

PRACTICE OF 2D DRAWINGS: Exercises of Orthographic views for simple solids using all commands in various tool bars.

Learning Resources:

Text Book(S):

N.D. Bhatt & V.M. Panchal - Engineering Drawing, 50th Edition, Charotar publishing house , 2010.

Reference Book(S):

1. Prof.K.L.Narayana & Prof. R.K.Kannaiah - Engineering Drawing, Scitech Publications, 2010.
2. James D. Bethune - Engineering Graphics with AutoCAD 2002, PHI, 2011.

Web References:

1. www.wikipedia.com
2. NPTEL Lectures

EE/EC 201	TRANSFORMATION TECHNIQUES	L	T	P	C
		4	--	--	3

Course Objectives:

1. To provide knowledge on Fourier series.
2. To provide knowledge on Fourier integrals.
3. To provide knowledge on Fourier transforms.
4. To make the student to learn Laplace and inverse transforms of a function.
5. To solve differential equation using Laplace transforms.

Course outcomes:
On completion of this course, students will be able to:
1. Find Fourier series.
2. Find Fourier integrals.
3. Find Fourier transforms.
4. Find Laplace and inverse transforms of a function.
5. Find solution of differential equations using Laplace transforms.

COURSE CONTENT:

UNIT I (Text Book 1) (12)
Fourier series
Introduction-Euler's formulae-conditions for a Fourier expansion-Functions having points of discontinuity-Change of interval.

Even and odd functions, Half range series.

UNIT II (Text Book 1) (12)
Parseval's formula, Practical harmonic analysis.

Fourier Transforms: Introduction-Fourier integral theorem (without proof)-Fourier sine and cosine integrals-Complex form of Fourier integral.

UNIT III (Text Book 1) (12)

Fourier transform-Fourier Sine and Cosine transforms.

Properties of Fourier transform (without proofs)-Linear-Change of scale-Shifting Convolution theorem - Parseval's identity for Fourier transforms.

UNIT IV (Text Book 1) (12)
Laplace Transforms :
Introduction-Transforms of elementary functions – Properties of Laplace transforms – Transforms of derivatives and integrals – Multiplication by t^n and division by t.

Laplace transform of periodic function. Evaluation of integrals by Laplace transforms.

UNIT V (Text Book 1) (12)
Inverse transforms – Convolution theorem (without proof).

Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only.

Learning Resources:

Text Book:

1. B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 40th edition, 2007.

Reference Book:

1. Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007

Web Resources:

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

EE/EC 202	ELECTRONIC DEVICES & CIRCUITS	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

1. To understand semiconductor basics like semiconductor material, its types, concepts of Drift current, diffusion current.
2. To understand the principle of operation and characteristics of Diode, Tunnel Diode and Rectifiers.
3. To understand the principle of operation and characteristics of BiPolar Junction Transistor.
4. To analyze the transistor biasing and thermal stabilization of transistor, operation and characteristics of JFET.
5. To understand the principle of operation and characteristics of MOSFET.

COURSE OUTCOMES:

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

1. Understand semiconductor basics like semiconductor material, its types, concepts of Drift current, diffusion current.
2. Understand the principle of operation and characteristics of Diode, Tunnel Diode and Rectifiers.
3. Design various Equipment which are used in the construction and operation of electronic devices.
4. Know about biasing and thermal stabilization of transistor. Understand the operation and characteristics of JFET.
5. Understand the operation and characteristics of JFET.

COURSE CONTENT:

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

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

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

BIPOLAR TRANSISTOR: The Bipolar Transistor Action, Minority Carrier Distribution, Low-Frequency Common-Base Current Gain, Nonideal Effects. Equivalent Circuit Models - Hybrid-Pi Model, Frequency limitations.

UNIT III **Text Book-2 (12)**

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_{C0} , V_{BE} , β , Thermal Runaway.

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

METAL-OXIDE-SEMICONDUCTOR FIELD-EFFECT TRANSISTOR: The Two Terminal MOS Structure, Capacitance-Voltage Characteristics, The Basic MOSFET Operation, Frequency limitations, Non-ideal Effects.

UNIT V **Text Book-1 ,2 (12)**

JUNCTION FIELD-EFFECT TRANSISTOR: JFET Concepts, The Device Characteristics, Non-ideal Effects, Equivalent Circuit and Frequency limitations.

RECTIFIERS: Half wave Rectifier and Full wave Rectifier with Capacitor filter.

Learning Resources:

Text Book(S):

1. Donald A. Neamen - Semiconductor Physics and Devices, 3rd Edition, TMH, 2003.
2. Jacob Millman and Christos C. Halkias - Integrated Electronics, TMH, 1972.

Reference Book(S):

Ben G Streetman and Sanjay Banerjee, Solid State Electronic Devices, 5th Edition,2000

Web Resources::

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

EE/EC 203	DIGITAL LOGIC DESIGN	L	T	P	C
		4	1	--	3

COURSE OBJECTIVES:

Students will be able to know

1. Theorems and functions of Boolean algebra and behaviour of logic gates.
2. Boolean functions simplification using Karnaugh maps and Quine-McCluskey methods
3. Combinational circuits design procedure and implementing them using PLDs
4. The behaviour and design of simple sequential circuits
5. The operation and design methodology for synchronous sequential circuits and Algorithmic State Machines

COURSE OUTCOMES:

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

1. Understand basic theorems in Boolean algebra and their relevance to digital logic design.
2. Get knowledge of Boolean functions minimization methods of Karnaugh Maps and The Quine-McCluskey methods.
3. Know the operation and design procedure of combinational circuits.
4. Understand the operation and design procedure of sequential circuits.
5. Comprehend the operation and design methodology for synchronous sequential circuits and Algorithmic StateMachines.

COURSE CONTENT:

UNIT I Textbook – 1 (13)

Signed Numbers and Complements, Addition and Subtraction Using R'sand (r-1)'s Complements, Codes. Boolean Algebra and Combinational Networks: Definition of A Boolean Algebra, Boolean Algebra Theorems, Boolean Theorems and Functions, Canonical Formulas, Manipulation of Boolean Formulas, Gates and Combinational Networks, Incomplete Boolean Functions and Don't Care Conditions, Additional Boolean Operations and Logic Gates.

UNIT II Textbook – 1 (13)

Karnagh Maps (upto five variables): Using Karnaugh Maps to Obtain Minimal Expressions for Complete Boolean Functions, Minimal Expressions of Incomplete Boolean Functions.

Quine-McCluskey Method: The Quine-McCluskey Method of Generating Prime Implicants and Prime Implicates, Prime Implicants / Prime Implicates Tables and Irredundant Expressions, Prime Implicants /Prime Implicates Table Reductions, Decimal Method for Obtaining Prime Implicants.

UNIT III Textbook – 1 **(**13)

Combinational Circuits: Binary Adders, Subtractors, Decimal Adders, Comparators, Decoders, Encoders, Multiplexers. PLDs, PROMs, PLAs, PALs.

UNIT IV Textbook – 1 **(**13)

Sequential Elements: Latches, Timing Considerations, Master-Slave Flip-Flops, Edge Triggered Flip-Flops, Characteristic Equations.

Sequential Circuits: Registers, Counters, Design of Synchronous Counters.

UNIT V Textbook – 1 (13)

Synchronous Sequential Networks: Structure and Operation of Clocked Synchronous Sequential Networks, Aynalysis of Synchronous Sequential Networks, Modeling Clocked Synchronous Sequential Network Behaviour.

Algorithmic State Machines: The Algorithmic State Machine, ASM Charts, Examples of Synchronous Sequential Network, Design using ASM Charts, State Assignments, ASM tables.

Learning Resources:

Text Book(S):

1. Donald D. Givone - Digital Principles and Design, TMH, 2003.

Reference Book(S):

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

Web Resources:

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

EE 204	NETWORK THEORY	L	T	P	C
		4	1	--	3

Course Objectives:

1. To know the methods of analysis of electrical circuits and apply circuit analysis to DC & AC circuits
2. To apply circuit analysis to AC circuits and to introduce the concept of poly phase systems.
3. To know the statement and application of various theorems.
4. To gain knowledge on PSPICE.

Course Outcomes:

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

1. Gain knowledge about methods of analyzing the circuits
2. Implement the network theorems to the electrical circuits
3. Analyse the balanced and unbalanced three phase systems.
4. Gain knowledge about the graphical representation of electrical circuits
5. Analyze electrical signals using Fourier series and response of circuits using PSPICE

COURSE CONTENT:

UNIT – I **Textbook – 1** **13**

Methods of analysis of electrical circuits :

Introduction, ideal, practical and dependent sources and their V-I characteristics, source transformation, Star delta transformation, average, RMS values, crest factor, form factor of different alternating waveforms, nodal analysis, super node analysis, mesh analysis, super mesh analysis for DC and AC circuits-problems.

UNIT-II **Textbook – 1&2** **13**

Application of network theorems to DC circuits:

Superposition theorem, Thevenin's and Norton's theorems, Reciprocity, Compensation, Maximum power transfer theorem, Tellegan's and Millman's theorems.

Application of network theorems to AC circuits:

Superposition theorem, Thevenin's and Norton's theorems, Reciprocity, Compensation, Maximum power transfer theorem, Tellegan's and Millman's theorems.

UNIT-III **Textbook – 1** **13**

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, Analysis of 3-phase unbalanced systems, star / delta transformation method, application of KVL and Millman's method. Measurement of 3-phase power- 2 wattmeter method, 3 wattmeter method.

UNIT-IV **Textbook – 1&2** **13**

Graph theory:

Introduction to graph theory, tree, co tree, twigs and links, incidence matrix, properties of incidence matrix, incidence matrix and KCL, link currents: tie set matrix, cutest and tree branch voltages.

UNIT-V

PSPICE: **Textbook – 1** **13**

Introduction to PSpice: D.C Analysis and control statements, dependent sources, DC Sweep, AC Analysis and control statements.
Fourier Series: Trigonometric and exponential Fourier series, representation of periodic function by Fourier series, Fourier transforms of simple functions, Applications to circuit analysis.

Learning resources:

Text books:
1. A Sudhakar and Shyam Mohan SP, “Circuits and Networks: Analysis and Synthesis”, TMH, 5th Edition, 2015.
2. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuit Analysis”, TMH, 8th Edition, 2012.

Reference books:
1. M.E.Vanvalkenburg, “Network Analysis”, PHI, 3rd Edition, 2006.
2. Franklin F.Kuo, "Network Analysis and Synthesis", Second Edition, John Wiley & Sons, 2009.

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 205	DC MACHINES	L	T	P	C
		4	--	--	3

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. Get an idea of magnetic circuits and their applications ,to get the knowledge of different properties magnetic materials and get knowledge of electro mechanical energy conversion
2. To gain the knowledge of working principle, construction, types of D.C generators, get an idea of armature reaction and commutation.
3. Get the complete idea of characteristics of D.C generators and their applications, to gain knowledge of principle of D.C motors and torque equations.
4. Get the complete idea of characteristics of D.C motors and their applications, gain the knowledge of speed control of D.C motors and necessity of starters.
5. Get the knowledge of testing of D.C motors and calculation of efficiency.

COURSE CONTENT:

UNIT - I [Text book -2] 12

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] 12

D.C. Machines:

Part I : Principle - constructional features - operation of DCgenerators .Losses and efficiency of generator, Types of Windings - lap and wave.

Part II : Armature reaction and compensations - commutation and inter poles.

UNIT-III [Text book -1, Text book -2,Reference book-1] 12

Part I :. No load and load characteristics of all types of DC generators and their applications ,Parallel operation of D.C. generators .

Part II : –Principle of D.C motor, Significance of back e.m.f,Torque and speed equations.

UNIT - IV [Text book -1, Text book -2,Reference book-1] 12

Characteristics of D.C Motors -applications . - speed control of D.C shunt, series and compound motors.

Starters of D.C motors: Necessity of a starter in a D.C motor , D.C motor starters and their design.

UNIT – V : **[**Textbook – 1] 12

Part I : Losses, efficiency of D.C motor and testing of DC machines - Swinburne's - Hopkinson's

Part II : Retardation Test- Field Test etc., Principle of operation of Amplidyne and Metadyne.

Learning Resources:

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.

Reference Books:

1.J. B. Gupta'.' Theory & performance of Electric Machines', S.K. Kataria&Sons.
2. Irving L. Kosow 'Electric Machinery & Transformers', PHI.
3. Clayton &Hancock'Performance and Design of D.C Machines', BPBPublishers.
4. S. Kamakshaiah 'Electro mechanics - I (D.C. Machines)''Right Publishers.
5. A.E. Fritzgerald, C. Kingsley &S. Umans'ElectricMachinary-', McGraw-HillCompanies, 6thediton 2003.
6. SamarjitGhosh 'Electrical Machines', Pearson 2nd edition, 2008

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 206	MECHANICAL TECHNOLOGY	L	T	P	C
		4	--	--	3

Course Objectives:

1. To provide sufficient theoretical and analytical background to understand the concepts of various equipments used in Thermal Plants
2. To make the student learn the mathematical approach for design of some mechanical equipment.
3. To develop skills for applying in future for various engineering applications.
4. To teach the working of power plant equipment.

Learning Outcomes:

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

1. Understand the concepts of mechanical elements in Thermal and Hydro-electric power plants.
2. Connect the course content to real time applications in various electrical power engineering applications.
3. Acquire the knowledge about basic manufacturing processes.
4. Acquire the knowledge about belt and gear drives for power transmission.
5. Have clear idea about the working of power plants, refrigeration, air conditioning and IC engines.

COURSE CONTENT:

UNIT-I (Text book-1)12

Transmission of Power by Belt Drive: Function of Belt drive, velocity ratios, slip in belts, ratio of tensions in a belt, length of belt- Open, Crossed, maximum power transmitted by belt drive.

Transmission of Power by Gear Drive: Advantages of Gear drive over Belt drive, Types of Gears, Spur, Helical, Bevel, Worm and Worm gear, nomenclature of Spur gears, Simple and Compound Gear trains.

UNIT-II (Text book-1) 12

Impact of Jets: Force of a jet impinging normally on a fixed plate, inclined plate and a series of moving vanes; jet impact on Fixed Curved vane, Moving Curved vane.

Hydraulic Turbines and Pumps: Classification, construction and working of Pelton wheel turbine, Francis turbine and Kaplan turbine, construction and working of Reciprocating and Centrifugal pumps.

UNIT-III (Text book-1) 12

Boiler and Steam Turbine: Working of Babcock-Wilcox water tube boiler and Cochran Fire tube boiler, Differences between Fire tube and Water tube boiler, principle and operation of Impulse and Reaction Steam Turbines, Differences between Impulse and Reaction Steam Turbines.

I.C Engines: Classification of IC Engines – Components in I.C engine, principles of SI & CI engines – comparison of 2 stroke & 4 stroke engine and SI & CI engines.

UNIT-IV (Text book-2) 12

Lathe: Constructional details, specifications, Different types of lathe, working and operations, Different work holding devices.

Milling Machine and Drilling Machine: Constructional details, specifications, working and operations.

UNIT-V (Text book-3) 12

Refrigeration Systems: Need for refrigeration, types, C.O.P, Bell-Colemanair refrigeration, vapour compression refrigeration.

Air conditioning Systems: Need for control of environment, psychrometric processes, summer and winter air conditioning systems –Components in air conditioning system.

Learning Resources:

Text Books :

1. Mathur, Mehta&Tewari, Elements of Mechanical Engineering, DhanpatRai& Sons, 13/E.

2. Hazra Chowdary., S.K. and Bose, Workshop Technology Vol. I and II, Media Promoters and Publishers Pvt. Ltd., 11/E.

3. Arora&Domkundwar, Refrigeration& Air-Conditioning , Dhanpat Rai& Co. Pvt. Ltd, 5th Edition, 1997.

Reference Books:

1. P.C. Sharma, Production Technology, S.Chand & Company Ltd., 5th Edition. 2004

2. A.R. Israt, P.K. Shah, Basic Mechanical Engineering, B.S. Publications, 2014

3.V.K. Manglik, Elements of Mechanical Engineering, PHI Learning Private Limited, 2013.

Web Resources:

1.http://www.efunda.com

2.www.howstuffworks.com

3.http://www.youtube.com

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

EE 251	NETWORKS & DC MACHINES LAB	L	T	P	C
		--	--	3	2

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. a) Verification of Kirchhoff's Laws
   b) Parameters of a given Choke Coil
2. Verification of Thevenin's Theorem
3. Verification of Superposition Theorem
4. Verification of Maximum power transfer theorem and reciprocity theorem
5. Locus diagrams of RL, RC and RLC circuits
6. Open circuit characteristics of separately excited / self excited D.C shunt generator
7. Load test on D.C Shunt Generator
8. Load test on D.C Compound Generator
9. Load test on D.C series generator
10. Swinburne's Test
11. Speed control of DC shunt motor
12. Brake test on D.C Shunt Motor
13. Hopkinson's test on D.C Machines
14. Retardation test on D.C. Machine
15. Simulation of RLC circuits using PSPICE
    i) Steady state analysis ii) Transient analysis
16. Verification of Thevenin's and Norton's theorems using P-SPICE
17. Verification of Maximum power transfer theorem and superposition theorem using P-SPICE

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, 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 252	ELECTRONIC DEVICES LAB	L	T	P	C
		--	--	3	2

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:

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 Semester End Examination.

LEARNING RESOURCES:

1. Millman&Halkias, Electronic Devices and circuits, TMH.
2. M Morris Mano, Digital Logic and Computer Design, PHI/Pearson Education, 2003.

WEB REFERENCES:

http://nptel.ac.in/courses/122106025/1#
http://nptel.ac.in/courses/117106114/

EE 253	MECHANICAL TECHNOLOGY LAB	L	T	P	C
		--	--	3	2

Course Objectives

1. Student will able to find flash and fire points of a given fuel using Cleveland apparatus.
2. Student will able to find the viscosity of lubricating oil using Saybolt viscometer.
3. Student will able to find the Calorific value of a gaseous fuel using Junker's Gas Calorimeter.
4. Student will able to do the Performance test on single cylinder, 4 -stroke petrol engine.
5. Student will able to do the Performance test on single cylinder, 4 -stroke diesel engine.
6. Student will able to make different patterns and mouldings for casting purpose.
7. Student will able to do turning operation on a Lathe.
8. Student will able to prepare a mould with different shapes and sizes of mouldings.

Course Outcomes

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

1. Know the importance of flash and fire point of fuel for storing and transporting the fuels.
2. Understand the importance of viscosity of lubricating oil.(cooling and reducing the friction between sliding parts).
3. Know the importance of calorific value of gaseous fuels.
4. Know how mechanical efficiency and brake thermal efficiency changes with change of the load at constant speed.(both Petrol and Diesel engines)
5. Implement techniques and methods for performing different lathe operations and producing different shapes of moldings.

List of Experiments:

1. Flash and fire points of a fuel using Cleveland apparatus.
2. Viscosity of a lubricating oil using Saybolt viscometer.
3. Calorific value of a gaseous fuel using Junker's Gas Calorimeter.
4. Valve Timing Diagram of single cylinder four stroke diesel engine.
5. Port timing Diagram of Single cylinder two stroke petrol engine.
6. Performance test on single cylinder, 4 - stroke Diesel Engine using electrical Dynamometer.
7. Performance test on single cylinder, 4 - stroke Diesel Engine using Band-brake.
8. Performance test on Twin cylinder, 4 - stroke diesel engine.
9. Performance test on Air compressor.
10. Study of Boilers.
11. Moulding: Stepped Cone Pulley.
12. Moulding: Hand Wheel.
13. Turning: Tapper Turning.
14. Turning: Thread Cutting.

Note: Minimum of any ten experiments has to be performed and recorded bythe candidate to attain eligibility for End Semester Examination.

Learning Resources:

Text Books:

1. Mathur, Mehta&Tewari, Elements of Mechanical Engineering, DhanpatRai& Sons, 13/E.

2. Hazra Chowdary., S.K. and Bose, Workshop Technology Vol. I and II, Media Promoters and Publishers Pvt. Ltd., 11/E.

3. Arora&Domkundwar, Refrigeration& Air-Conditioning , Dhanpat Rai& Co. Pvt. Ltd, 5th Edition, 1997.

Web References:

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

EE/EC207	COMPLEX AND NUMERICAL ANALYSIS	L	T	P	C
		4	--	--	3

Course Objectives:

1. To provide knowledge on complex analysis
2. To provide knowledge on complex integration.
3. To provide knowledge on singularities, poles and residues.
4. To provide knowledge on numerical solution of ordinary differential equations.
5. To provide knowledge on numerical solution of partial differential equations.

Course outcomes:
On completion of this course, students will be able to:
1. Apply Cauchy-Riemann equations and harmonic functions to problems of fluid mechanics, thermodynamics and electro-magnetic fields.
2. Evaluate complex line integrals.
3. Find singularities of complex functions and determine the values of integrals using residues.
4. Find numerical solution of ordinary differential equations.
5. Find numerical solution of partial differential equations.

COURSE CONTENT:

UNIT I **Text Book – 1 (12)**
Complex Functions Introduction - Derivative of complex function - Analytic functions - The necessary and sufficient conditions for the analyticity of the function (without proof) - Cauchy-Riemann equations in polar form - Harmonic functions

Milne-Thomson method, orthogonal system.

UNIT II **Text Book – 1 (12)**
Complex Integration Complex integration - Line integrals
Cauchy's integral theorem, Cauchy's integral formulae.

UNIT III **Text Book – 1 (12)**
Series and Residues :Taylor's and Laurent's expansions (without proofs).
Singularities – Poles and Residues – Cauchy's residue theorem (without proof).

UNIT IV **Text Book – 1 (12)**
Numerical Solutions of Ordinary Differential Equations (First order)
Solution by Taylor's series – Picards method
Euler's method - Runge-Kutta method of fourth order.

UNIT V **Text Book – 1 (12)**
Numerical Solutions of Partial Differential Equation Classification of Partial differential equations of the second order – Laplace's equation.
Poisson's equation.

Learning Resources:

Text Book:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

Reference Book:

1. Advanced Engineering Mathematics by Erwin Kreyszig.

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

EE/EC 208	ELECTRONIC CIRCUIT ANALYSIS	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

1. To provide basic knowledge on analysis, design, and measurement of linear analog electronics.
2. To gain the knowledge in low frequency and high frequency Transistor amplifier analysis.
3. To acquire knowledge on feedback topologies
4. To know about various power amplifier circuits.

COURSE OUTCOMES:

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

1. analyze linear analog electronic circuits involving Bipolar Junction (BJT) and Field Effect (FET) transistors at both low and high frequencies.
2. analyze frequency response of transistor amplifier circuits.
3. understand four feedback topologies and their practical circuits.
4. analyze RC,LC and Crystal Oscillators.
5. analyze and design the Power amplifiers.

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

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.

FET AMPLIFIERS: MOSFET DC Circuit Analysis, The MOSFET Amplifier, The Common Source Amplifier, The Common Drain Amplifier, The Common Gate Configuration, Single-Stage Integrated Circuit MOSFET Amplifiers, Multistage Amplifiers.

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

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.

UNIT III *Text Book - 2***(12)**

FEEDBACK AMPLIFIERS : Classification of amplifiers, The feedback concept, the transfer gain with feedback, general characteristics of Negative Feedback, the Four Basic Feedback Topologies, voltage Series Feedback Amplifier, Current Series Feedback Amplifier, Current Shunt and Voltage Shunt Feedback Amplifiers.

UNIT IV *Text Book - 3* **(12)**

OSCILLATORS : Barkhausen Criterion for Sinusoidal Oscillators, RC Phase Shift Oscillator using FET and BJT, Wein Bridge, Hartley, Colpitt's Oscillators using BJT, Tuned Resonant Oscillator, Crystal Oscillators, Frequency and Amplitude Stability Criterion for Oscillators.

UNIT V *Text Book – 1(***12)**

INTEGRATED CIRCUIT BIASING AND ACTIVE LOAD: Bipolar Transistor Current Sources, FET Current Sources, Circuits with Active Loads, Small Signal Analysis of Active Load Circuits.

OUTPUT STAGES AND POWER AMPLIFIERS: Power Amplifiers, Power Transistors, Classes of Amplifiers, Class-A Power Amplifiers, Class-AB Push-Pull Complementary Output Stages.

Learning Resources:

Text Book(S):

1. 1. Donald A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, TMH, 2007.
2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 5th Edition, Oxford University Press, 2004.
3. Jacob Millman and Christos C. Halkias, Integrated Electronics, TMH, 1972.

Reference Book(S):

Paul R Gray, Gray J. Hurst, Stephen H. Lewis and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 4thedition, John Wiley and Sons, 2001.

Web Resources:

1. http://nptel.ac.in/courses/117101106
2. http://nptel.ac.in/courses/117107094/22

EE 209	NETWORK ANALYSIS & SYNTHESIS	L	T	P	C
		4	1	--	3

Course Objectives:

1. To introduce the concept of transients and different transient analysis approaches.
2. To evaluate different two port network parameters.
3. To know the concept of poles and zeros and transformed network analysis
4. To understand the concept of coupled circuits and filters.
5. To synthesize networks and to know the difference between analysis and synthesis.

Course Outcomes:

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

1. Understand the concept of steady state, transient analysis for different circuits with DC and sinusoidal input.
2. Gain knowledge about two port network parameters and interrelations of two port networks.
3. Understand the concept of pole , zero and determine the responses of different circuits for pulse and impulse excitations.
4. Gain knowledge about the coupled circuits and filters
5. Understand the concept of Hurwitz polynomial, synthesis of different networks.

COURSE CONTENT:

Unit-1 **Text Book – 1** **13**

Transient analysis using differential equation approach:

Steady state and transient response, source free, DC and sinusoidal response of series and parallel R-L, R-C, R-L-C circuits.

Transient analysis using Laplace transformation approach:

Steady state and transient response, source free, DC and sinusoidal response of series and parallel R-L, R-C, R-L-C circuits.

Unit-II **Text Book – 1** **13**

Two port networks:

Open circuit impedance and short circuit admittance parameters, transmission (ABCD) and inverse transmission parameters, hybrid and inverse hybrid parameters.

Interrelationships and interconnections of two port networks:

Interrelation between two port network parameters, image parameters, inter connection of two-port networks using cascade, series, parallel connections, terminated two port network.

Unit-III Text Book – 1 13

Network functions:

Response of RL, RC circuits for impulse and pulse excitations using laplace transform methods. 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.

Unit-IV **Text Book – 1** **13**

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) **Filters**:

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

Unit-V **Text Book – 1** **13**

Network synthesis:

Hurwitz polynomial – properties of Hurwitz polynomials- continued fraction expansion, properties of positive real functions – numerical problems for one port reactive network.

Synthesis of RC, RL driving point impedances and RL, RC admittances – CAUER and FOSTER methods of Synthesis.

Learning resources:

Text books:

1. A Sudhakar and Shyam Mohan SP, “Circuits and Networks: Analysis and Synthesis”, TMH, 5th Edition, 2015.
2. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuit Analysis”, TMH, 8th Edition, 2012.

Reference books:

1. M.E.Vanvalkenburg, “Network Analysis”, PHI, 3rd Edition, 2006.
2. Franklin F.Kuo, "Network Analysis and Synthesis", Second Edition, John Wiley & Sons, 2009.

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://pbtstudies.blogspot.in/

EE 210	AC MACHINES	L	T	P	C
		4	1	--	3

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. Get an idea of a transformer and their applications, to get the knowledge of different types of losses and testing of transformers and to solve the problems related to transformers.
2. To gain the knowledge of different types of connections like star-deltd,3-ph to 2-ph and get the knowledge of parallel operation and load sharing.
3. Get the complete idea of poly phase induction motor and its testing and to draw Equivalent circuit.
4. Get an idea to draw the circle diagram and to get an idea about starters, speed control and also get an idea about the induction generator and its applications.
5. Get the knowledge of 1-ph induction motors and their characteristics and their applications.

COURSE CONTENT:

UNIT - I [Text Book- 1] 13

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.

UNIT - II [Text Book- 2] 13

Auto transformers - Tertiary transformer winding - 3 phase transformer windings and its connections. Open delta - Scott connected transformers - 3 phase to 2 phase conversion.

Parallel operation of transformer and its load sharing. Tap changing - methods of cooling.

UNIT - III [Text Book- 1] 13

Poly Phase Induction Motors: Rotating magnetic field in two phase & three phase systems - construction and operation of squirrel cage and slip ring 3-phase induction motors.
Torque equation and torque slip characteristics - equivalent circuit.

UNIT –IV [Text Book-1] 13

Power losses - efficiency - testing of induction motors and circle diagrams.

Types of starters - speed control of induction motors - Crawling and Cogging -Double cage rotors - Induction generators and their applications.

UNIT – V [Text book-1] 13

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 211	DATA STRUCTURES USING C++	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

1. To understand Object Oriented Programing features of C++.
2. To understand the concepts encapsulation, inheritance, and polymorphism.
3. To understand the concepts inheritance, Runtime polymorphism and Templates.
4. To understand the concepts of Lists, Stacks and Queue ADT's.
5. To understand Binary trees and ADT's of BST and Various sorting techniques.

COURSE OUTCOMES:

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

1. understand C++ fundamentals and various function modifiers, create and manipulate classes and objects.
2. make use of the concept Inheritance and its types and efficiently develop reusable and extensible programs.
3. apply the concept of templates for generic programming.
4. write programs for various data structures and their applications.
5. compare complexities of different sorting and searching techniques..

UNIT I T*ext Book - 1* **(12)**

An Overview of C++ : The Origins of C++, What is Object Oriented Programming, some C++fundamentals, Old-Style Vs Modern C++, Introducing C++ Classes, Function Overloading, Operator Overloading, Inheritance, Constructors and Destructors, The C++ Keywords, The General Form of a C++ Program.

Classes and Objects: Classes, Structures and Classes, Unions and Classes are Related, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, Scope Resolution Operator, Nested Classes, Local Classes, Passing and Returning Objects, Object Assignment.

Arrays, Pointers, References and the Dynamic Allocation: Arrays of Objects, Pointers, References, Dynamic Allocation Operators, the Placement Forms of new and delete.

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

Function Overloading, Copy Constructors and Default Arguments : Function Overloading, Overloading Constructor Functions, Copy Constructors, Finding the Address of an Overloaded Function, Overload Anachronism, Default Arguments, Function Overloading and Ambiguity.

Operator Overloading: Creating Member Operator Function, Overloading Using a Friend Function, Overloading new delete, Overloading Special Operators & Comma Operator.

UNIT III *Text Book – 1 (***12)**

Inheritance: Base-Class Access Control, Inheritance and protected members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.

Virtual Functions &Polymorphism: Virtual Functions, The Virtual Attribute is inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early Vs Late Binding.

Templates: Generic Functions, Applying Generic Functions, Generic Classes, Type name and export Keywords, Power of Templates.

UNIT IV *Text Book - 2* **(12)**

LINKED LISTS : Abstract Data Types, The List ADT, Linked Lists, Polynomial ADT, Doubly Linked Lists, Circular Linked lists.

THE STACK and QUEUE ADT: Stack Model, Implementation of Stacks, Applications: Conversion of infix expression to postfix Expression, postfix evaluation, Queue implementation.

UNIT V *Text Book - 2* **(12)**

TREES: Preliminaries, Binary Trees, Binary Tree Traversals, Binary Search Tree.

SORTING: Shell sort, Merge sort, Quick sort, Heap sort.

Learning Resources:

Text Book(S):

1. The Complete Reference - C++ by Herbert Schieldt, 4/e, Tata McGraw Hill
2. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4/e , Pearson

Reference Book(S):

1. Object Oriented Programming with C++, E. Balaguruswamy, 4/e, Tata McGraw Hill.
2. An Introduction to Data Structures with Applications, Trembley and Sorenson, 2/e, Tata McGraw Hill, 2001.

Web Resources:

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

EE 212	ELECTROMAGNETIC FIELD THEORY	L	T	P	C
		4	1	--	3

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. Understand concepts of fields.
2. Solve electrostatic field problems.
3. Understand electric and magnetic properties of material media and how these properties can be exploited in engineering applications.
4. Solve various magneto static field problems.
5. Understand the concepts of Maxwell's equations and their usage.

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.

UNIT – III (TEXT BOOK 1 &2) 13

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

Magneto statics:

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

UNIT – IV (TEXT BOOK 1 &2) 13

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 – V (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:

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

EE 254	AC MACHINES LAB	L	T	P	C
		--	--	3	2

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. Determination of Z, Y parameters of a given two port network
2. 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
12. Parallel operation of 3 – phase transformers
13. Harmonic analysis of transformer
14. Separation of losses 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 255	DATA STRUCTURES LAB	L	T	P	C
		--	--	3	2

COURSE OBJECTIVES:

1. To understand Object Oriented Programing features of C++.
2. To understand the concepts of encapsulation and compile time polymorphism.
3. To understand the concepts of inheritance, Runtime polymorphism and Templates.
4. To understand the concepts of Lists, Stacks and Queue ADT's.
5. To understand Binary trees and ADT's of BST and Various sorting techniques.

COURSE OUTCOMES:

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

1. implement basic Object Oriented features of C++.
2. implement the concepts of encapsulation and compile time polymorphism.
3. implement the concepts of Inheritance, Runtime polymorphism and Templates.
4. implement Lists, Stacks and Queue ADTs.
5. implement BST ADT and different sorting algorithms.

List of Experiments:

1. Create a class HUGEINT by which we would be able to use much wider range of integers. Perform addition operation on two HUGEINTs.
2. Create a class TIME with appropriate data members to represent TIME. Construct a class implementation section to compare two TIMEs, to increment TIME by one second, to decrement TIME by one second and appropriate constructors to create TIME objects.
3. Write a class declaration for DATE and allow the operations to find nextday(), previousday(), leapyear(), compare() with appropriate constructors and destructors.
4. Create a user defined datatype STRING, allow possible operations by overloading (Relational operators, [], ( ), >, =).
5. Define RATIONAL class. Allow possible operations on RATIONALs by overloading operators (Arithmetic, Unary operators,>).
6. Program to implement (a) Single inheritance (b) Multiple inheritance (c) Hierarchical inheritance (d) Multipath inheritance.
7. Program to implement (a) runtime polymorphism (b) abstract base class concept.
8. Program to implement operations on single linked list.
9. Program to implement operations on doubly linked list.
10. Program to implement stack operations using arrays (with class templates) and linked lists.
11. Program to implement Queue operations using arrays and linked list.
12. Program to sort n elements using

a) Merge Sort (with function templates).b) Quick Sort. c) Heap Sort.

13. Program to demonstrate BST ADT.

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

Learning Resources:

1. E Balaguruswamy, Object Oriented Programming with C++
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++

EE 256	PROFESSIONAL COMMUNICATION SKILLS LAB	L	T	P	C
		--	--	3	2

COURSE OBJECTIVES:

The Professional Communication Skills Lab prepares students to

1. improve the dynamics of professional presentations.
2. develop the ability to compeer professional occasions.
3. enable to read news paper for their communicative competence.
4. equip with effective business correspondence.
5. develop in them communication and social graces necessary for functioning.
   * for employable ready skills * win in the job interviews * Build confidence to handle professional tasks.

COURSE OUTCOMES:

After successful completion of the course, the students will

1. develop effective communication and presentation skills.
2. learn corporate etiquette - organizing and managing professional events.
3. understand how reading enhances their communicative competency.
4. conduct effective correspondence and prepare reports which produce results.
5. develop all-round personalities with a mature outlook to function effectively in different circumstances.

List of Exercises / Activities:

1. **Presentation skills:**

   (a) Key presentation skills inspired by Steve Jobs - You Tube.

   (b) Personality & finishing skills training videos.

   How to make Effective Presentations, Methodology, Structure, using Technology and Conclusion.

2. **Speech writing:**

   (a) Welcoming guests on to the stage. (b) Proposing vote of thanks.

   Invite and thank people with professional etiquette.

3. **Reading skills:**

   (a) News paper reading (b) Reading and interpretation

   News paper reading - loud reading within the groups. Reporting the news with one another without the help of the news paper.

   (Besides this, motivate students to read News Paper every day without fail.)

4. **Writing Skills:**

   Report writing (a) Feasibility report (b) Project report

   (Writing an Abstract - Parts of a report - Title page - Declaration - Acknowledgements - Table of contents - Introduction - Conclusion - Citations - References - Appendices.)

5. **Career skills:**

   (a) Resume & Cover letter. (b) Interview - The purpose & preparation for an interview.

   Discover oneself - Self Introduction - Social background (family, home and town) - interests,

Hobbies, likes & dislikes (persons, places, food, music, etc) - Strengths, Weaknesses, Skills, Qualities, Achievements - Opinions (love, life, marriage, politics, India, etc) what is life according to me? A creative narration with factual information is expected.

Effective Resume writing: structure and presentation - planning and defining the career objective - strengths and skills set - format - cover letter.

Facing Interviews: Interview Process - Understanding employer expectations - Pre-interview planning - Opening strategies - Answering strategies, Frequently Asked Questions (FAQs).

Learning Resources:

Reference Book(S) :

1. Business Communication, II Ed, OUP, by Meenakshi Raman & Prakash Singh, 2012.
2. Technical Communication - English Skills For Engineers, II Ed, OUP by Meenakshi Raman & Sangeetha Sharma, 2011.(Unit-IV).
3. Technical Communication - Principles and Practice, II Ed, OUP by Meenakshi Raman & Sangeetha Sharma, 2015.(Unit-V)

Software :

TOEFL Mastery, Rosetta Stone, TED Talks, Globarena, Clarity.

Web Resources :

www.esl-lab.com, www.eslgold.com

EE/EC 301	PULSE AND DIGITAL CIRCUITS	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

1. To know the responses of first order RC low pass and high pass filters for standard inputs
2. To know the transfer characteristics of clipping circuits and the response of clamping circuits for sinusoidal and square wave signals.
3. To do the analysis and design of multivibrators using BJTs
4. To know the methods of generating voltage sweep waveforms
5. To know the concepts of TTL, ECL,NMOS and CMOS logic families

COURSE OUTCOMES:

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

1. understand and analyze the responses of first order RC low pass and high pass filters for standard inputs.
2. understand the transfer characteristics of clipping circuits and the response of clamping circuits for sinusoidal and square wave signals.
3. understand the operation, analysis and design of multivibrators using BJTs
4. understand the operation of Miller and Bootstrap sweep circuits.
5. understand the operation of TTL, ECL,NMOS and CMOS logic families

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

LINEAR WAVE SHAPING: Responses of RC-high pass circuit and low pass circuits to sinusoidal, step, pulse, square, ramp and exponential inputs, Criteria for good differentiation and integration, uncompensated and compensated attenuators, RLC circuits and their response for step input, ringing circuit.

UNIT II **Text Book - 1 (10)**

NON-LINEAR WAVE SHAPING: Clipping circuits with diodes, clipping at two independent levels, transfer characteristics of clippers, multi-diode circuits, transient and steady state response of a diode clamping circuit, clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, transfer characteristics of clampers.

UNIT III **Text Book - 1 (15)**

MULTIVIBRATORS (using BJTs): Bistable Multivibrator: fixed bias transistor binary (only), commutating capacitors, unsymmetrical and symmetrical triggering of binary, schmitt trigger circuit.

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

MULTIVIBRATORS (Contd..) collector coupled monostable and astable multivibrators - operation &design.

SWEEP CIRCUITS: Voltage sweep circuits, deviation from linearity expressed as errors, principles of miller and bootstrap sweep circuits, miller circuit, bootstrap circuit.

UNIT V **Text Book - 2 (12)**

Digital Circuits: Fundamental concepts of digital circuits, cmos logic family, nmos logic family, TTL logic family, emitter coupled logic family

Learning Resources:

Text Book(S):

1. J Millman and H Taub - Pulse Digital and Switching Circuits, TMH, 2003
2. Mark N Horemstein - Microelectronic Circuits and Devices, 2nd Edition, PHI, 1996

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/EC302	MICROPROCESSORS & MICROCONTROLLERS	L	T	P	C
		4	1	--	3

COURSE OBJECTIVES:

1. To understand the architecture of 8086 family, addressing modes, Instruction description and assembler directives of 8086 microprocessor.
2. To develop the programming skills for applying them on various applications of 8086 microprocessor.
3. To understand 8086 systems connections and programmable parallel ports
4. To understand Analog interfacing with 8086 and learn different programmable peripheral devices.
5. Understand architecture of 8051microcontroller.

COURSE OUTCOMES:

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

1. understand architecture and programming model of 8086 microprocessor.
2. develop the assembly language programs for different problems using 8086.
3. understand 8086 system connections and Timings, Digital Interfacing.
4. understand Analog interfacing with 8086 and different programmable peripheral devices.
5. understand the architecture of 8051 microcontroller.

UNIT I *Text Book - 1* **(13)**

Introduction to microcomputers and microprocessors, The 8086 Microprocessors family-overview, 8086 internal architecture, Introduction to programming the 8086, 8086 Instruction Descriptions and Assembler Directives.

UNIT II *Text Book - 1* **(13)**

Program Development steps, writing programs for use with an assembler, assembly language program development tools, writing and using procedures, writing and using assembler macros, 8086 Interrupts and Interrupt responses.

UNIT III *Text Book - 1* **(13)**

8086 System Connections : 8086 Microprocessor pin diagram, minimum mode and maximum mode of 8086, 8086 bus activities during a read machine cycle, 8086 bus activities during a write machine cycle, addressing memory and ports in microcomputer systems.

Digital Interfacing: Programmable parallel ports and handshake Input/ Output: Methods of parallel data transfer, Implementing Handshake data transfer, 8255A Internal Block Diagram and System connections, 8255A operational modes and initialization, constructing and sending 8255A control words. Interface microprocessor to keyboards.

UNIT IV *Text Book - 1* **(13)**

Analog Interfacing: D/A converter operation and specifications, D/A Applications and Interfacing to Microcomputers, A/D converter specifications, A/D converter Types, and Interfacing Different types of A/D converters to Microcomputers.

Programmable peripheral devices: 8254, 8259, 8251, DMA data transfer, RS232 communication

standard.

UNIT V *Text Book - 2* **(13)**

Introduction to microcontrollers, comparing microprocessors and microcontrollers, Architecture: Architecture of 8051, pin configuration of 8051microcontroller, Input/output pins, ports and external memory, counters and timers, serial data Input / Output and interrupts, Addressing modes of 8051 microcontroller.

Learning Resources:

Text Book(S):

1. Douglas V. Hall - Microprocessors and Interfacing, 2nd Edition, TMH, 2006.
2. Kenneth J.Ayala - The 8051 Microcontroller Architecture, Programming and Applications, Second Edition, Penram International Publishers, 2005.

Reference Book(S):

1. John Uffenbeck - The 80X86 Family, Design, Programming and Interfacing, 3rd Edition, Pearson Education, 2002.
2. Barry B.Bray - The intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium processors, architecture, programming, and interfacing, 6th Edition, PHI edition, 2003.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.Mckinlay - The 8051 Microcontroller and Embedded Systems, Pearson Education, second edition 2006.

Web Resources:

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

EE 303	LINEAR CONTROL SYSTEMS	L	T	P	C
		4	1	--	3

Course Objectives:

1. To provide sufficient theoretical and analytical background to understand the concepts of continuous time linear control systems
2. To make the student to learn the mathematical applications related to control systems
3. To develop skills for applying them in future on various engineering applications
4. To analyse and design of feedback control systems
5. 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, the student will be able to:

1. Understand the concepts of continuous time linear control systems
2. Assess the stability of feedback control system with classical approach
3. Design simple control systems and modify the parameters to meet specific requirements
4. Understand the modeling and analysis of linear control systems using state space approach
5. Connect the course content to real time applications in various electrical and electronics engineering applications, pursue advanced courses in control systems and get solutions for problems related to control systems in competitive examinations.

Course Content:

UNIT – I **[Text book-1] (13)**

Introduction: Basic concept of simple control system – open loop – closed loop control systems. Effect of feed back on overall gain – stability sensitivity and external noise.
Types of feed back control systems – Liner time invariant, time variant systems and non linear 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] (13)**

Time Response analysis: Standard test signals – step, ramp, parabolic and impulse response function – characteristic polynomial and characteristic equations of feed back 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.

UNIT – III **[Text Book-1] (13)**

Concepts of Stability: Absolute, relative, conditional, bounded input –bounded output, zero input stability, conditions for stability, Routh –Hurwitz criterion.
Root locus Technique: Introduction – construction of root loci

UNIT –IV **[Text Book 1] (13)**

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

UNIT – V **[Text Book 1] (13)**

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 304	SYNCHRONOUS & SPECIAL MACHINES	L	T	P	C
		4	--	--	3

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 Outcomes:

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

1. Understand the Construction, Working principle of operation of three phase Synchronous Generator and analyze the methods of determining the Voltage Regulation.
2. Understand the specifications of synchronous generators and are able to solve problems involving synchronous machines operating alone or in parallel.
3. Comprehend the Three phase synchronous Motor operation, Characteristics, Performance and Applications.
4. Gain knowledge in principle of working, specifications and applications of universal motor and single phase ac series motor.
5. Gain knowledge in principle of operation, Construction and characteristics of Single Phase Synchronous Motors, Stepper Motors and Liner Induction Motor

COURSE CONTENT:

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

Three phase Synchronous Generator: Construction, Excitation Systems – DC Excitation, AC Excitation and Brushless Excitation

E.M.F Equation with sinusoidal flux - winding factors - harmonics in generated voltage and their suppression, Armature Reaction - Synchronous impedance – vector diagram - load characteristics.

UNIT - II [Text Book- 1 &2] (12)

Synchronous Generator Voltage Regulation: Methods of determining regulation – direct load – EMF, MMF, ZPF and ASA.

Salient Pole Synchronous Machine: Blondel two reaction method for salient pole machine - phasor diagram - slip test - regulation of salient pole machines.

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

Synchronous Generators parallel operation: Parallel operation - synchronizing with infinite bus bars - synchronizing power - effect of variation of excitation and mechanical input on parallel operation

Load sharing during parallel operation – Power Angle characteristics of Synchronous Generator, Losses and efficiency of Synchronous Machine.

UNIT - IV [Text Book- 2&3] (12)

Three Phase Synchronous Motor: Theory of operation - starting methods – phasor diagrams - variation of current and power factor with excitation.

Excitation and Power circles. V and inverted V curves, hunting and its prevention - synchronous condenser and its applications.

UNIT - V

[Text Book- 2&3] (12)

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 characteristics of reluctance motor and hysteresis motor.

Stepper Motors: Variable Reluctance Stepper Motor - Permanent Magnet Stepper Motor - principle of operation of Linear Induction Motor and its Applications.

Learning Resources:

Text Books:

1. Electric Machinery by P.S. Bhimbra, Khanna Publications 7th edition.
2. Electrical Machinery by D.P.Kothari and I.J.Nagrath 4th edition ,Tata McGraw-Hill-2006
3. Electrical Machines by S.K Bhattacharya Tata McGraw-Hill

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. Ashfaq Hussain,"Electric Machines", 2nd edition, Dhanpath Rai& Co,2014
4. Electric Machinery - by A.E. Fitzgerald, C.Kingsley and S.Umans, McGraw-Hill Companies, 6th edition, 2003.

Web Resources:

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 305	GENERATION OF ELECTRICAL POWER	L	T	P	C
		4	--	--	3

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. 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 CONTENT:

UNIT - I [Text Books 1&2] (12)
Choice of power stations and units: Types of power stations – choice of generation - size of generator units - effect of variable load on plant operation and design.
Tariff: Characteristics of Tariff - types of Tariff.
Gas Turbine Plants: Layout of gas turbine plant - principle of operation - open cycle and closed cycle plants. Improvement of thermal efficiency of gas plant.

UNIT – II [Text Books 1&2] (12)
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 - III [Text Books 1&2, Reference Book 2] (12)
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.
Combined cycle Plants: Introduction - stag combined cycle plant - combined cycle with nuclear gas turbine and fossil fuel fired steam turbine

UNIT – IV [Reference Book2, Reference Book 3] (12)
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 - V [Text Books 1&2] (12)
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, load curve & load duration curve
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.

Learning Resources:

Text Books:

1. M.V. Deshpande , Elements of Electrical power station design ,Wheeler Publishing Co.
2. B.R. Gupta, Generation of Electric Power S. Chand & Company Ltd.
3. G. D. Rai ,Non conventional energy sources by Khanna Publishers,New Delhi

Reference Books:

1.B.S.Magal, Solar power engineering, TMH Publishing Company. Ltd., New Delhi.
2. M.M.el.Wakil, Power plant Technology, TMH Publishing Company. Ltd.,New Delhi.
3. M. N. Bandyopadhyay, Electrical power systems theory and practice -PHI.
4. C.L. Wadhwa, Generation distribution and utilization of electrical energy,New Age International (P) Limited, 2005.
5. John Twidell& Tony Weir , Renewable Energy Resources, 2nd Edition,Taylor & Francis, 2007.

Web Resources:

1. www.nptel.iitm.ac.in
2. http://solarsystem.nasa.gov/planets/sun
3. www.microhydropower.net

EE 306	TRANSMISSION & DISTRIBUTION	L	T	P	C
		4	1	--	3

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. Understand the types of conductors used for electrical system and classification of transmission lines and Get solutions for problems related to inductance and capacitance.
2. Analyze the performance of short, medium and long transmission lines and identify the transmission system which requires minimum volume of conductor materials.
3. Classify the types of insulators, testing of insulators and calculation of string efficiency.
4. Understand the types of cables and theory of underground cables.
5. Classify the types of arrestors and substations, understand substation layout and equipment.

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 - sending and receiving end power angle equations and power circle diagrams. 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.

Grading of insulators: Failure of insulator and testing, arcing horns.

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.

Travelling wave Phenomenon: Travelling waves on transmission lines, attenuation of travelling waves.

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

Protection against travelling waves: Rod gaps - sphere gaps – different types of arrestors and surge absorbers.

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. en.wikipedia.org/wiki/ Electric_power_...
2. www.gepower.com/prod_serv/plants_td/e...
3. www.tatapower.com
4. http://nptel.iitm.ac.in

EE 351	SYNCHRONOUS & SPECIAL MACHINES LAB	L	T	P	C
		--	--	3	2

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 Outcomes:

After completion of this lab course, the student are able to:

1. Calculate the regulation of alternators by various methods.
2. Synchronize the alternators with infinite buses bars and calculate different parameters.
3. Know the performance of special motors.
4. Know the performance of synchronous 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 $\mathbf{X_d}$and$\mathbf{X_q}$ of a three phase alternator by slip test
10. Load test on Universal motor
11. Measurement of $\mathbf{X_d}$" and $\mathbf{X_q}$" 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 synchronous 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.

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 352	ELECTRONIC CIRCUITS LAB	L	T	P	C
		--	--	3	2

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.

WEB RESOURCES:

1.http://nptel.iitm.ac.in
2.http://nptel.ac.in/courses/122106026/
3.http://nptel.ac.in/courses/122104013/#

EE 353	MICROPROCESSORS & MICROCONTROLLERS LAB	L	T	P	C
		--	--	3	2

Course Objectives:
1. To develop the microprocessor and microcontroller based programs for various problems
2. To develop the microprocessor and microcontroller based programs for various applications.

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

1. Gain the logical development of programs on the 8086 microprocessor and 8051 microcontroller.
2. Understand how to interface 8086 microprocessor to external world.

LIST OF EXPERIMENTS:
Experiments Based on ALP (8086)

4. Programs on Arithmetic and Logical Instructions.
5. Programs on Data Transfer Instructions.
6. Programs on Branch Instructions.
7. Programs on Subroutines.
8. Sorting of an Array.
9. Programs on Interrupts (Software and Hardware).
10. 8086 Programs using DOS and BIOS Interrupts.

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

11. DAC Interface-Waveform generations.
12. Stepper Motor Control.
13. Keyboard Interface / LCD Interface.
14. Data Transfer between two PCs using RS.232 C Serial Port
15. Programs on Data Transfer Instructions using 8051 Microcontroller.
16. Programs on Arithmetic and Logical Instructions using 8051 Microcontroller.
17. 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 University Practical Examination.

Learning Resources:
Text Books:

1. Douglas V. Hall – Microprocessors and Interfacing, 2nd Edition, TMH,2006.
2. Kenneth J.Ayala – The 8051 Microcontroller Architecture, Programming and
3. Applications, Second Edition, Penram International Publishers, 2005.

Web references:
1. https://www.youtube.com/watch?v=RVNXZS-HOgw
2. https://www.youtube.com/watch?v=liRPtvj7bFU

EE 307	LINEAR ICS AND APPLICATIONS	L	T	P	C
		4	--	--	3

Course Objectives:

1. 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. Understand the basics of linear integrated circuits and operational amplifiers with applications.
2. design wave shaping circuits
3. design simple filter circuits & Oscillators for particular application
4. understand analog to digital converters (ADC), and digital to analog converters (DAC)
5. gain knowledge in designing a stable voltage regulator and understands the applications of PLL and special ICs.

COURSE CONTENT:

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

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] (12)
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.

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

UNIT - V [Text Book-2] (12)

SPECIAL ICs: The 555 timer, 555 as Monostable and Astable Multi vibrator and applications.lc 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", PHI/ Pearson Education, 4th Edition, 2003.
2. D. Roy and Choudhury, ShailB.Jain, "Linear Integrated Circuits", New Age International, 2nd Edition, 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". PHI/Pearson Education, 4thedition,2002.
3. David A.Bell, "Op-amp & Linear ICs". Prentice Hall of lndia, 2ndedition, 1997.

WEB REFERENCES.
1. http://www.electronics-tutorials.ws/opamp/
2. https://www.sonoma.edu/users/m/marivani/es231/units/experiment_03.shtml
3. http://www.radio-electronics.com/info/circuits/opamp_basics/operational-amplifier-basics-tutorial.php
4. http://www.circuitstoday.com/category/integrated-circuits

EE 308	POWER SYSTEM ANALYSIS & STABILITY	L	T	P	C
		4	1	--	3

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:

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

1. Draw one line diagrams and understanding of solving per unit computations.
2. Identify operation of grid connected synchronous machine and selection of capacity of protective devices upon conducting fault analysis.
3. Assess stability of power system network.
4. Get solutions for problems related to power systems in competitive examinations.
5. Connect the course content to real time applications in various electrical and electronics engineering applications.

COURSE CONTENT:

UNIT - I [Text Book- 1] (13)

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- 2] (13)

Power flow control: Power angle equation of a synchronous machine- effect of synchronous machine excitation.

Symmetrical Faults: Transients in RL series circuit - short-circuit currents and reactances of synchronous machines - internal voltages of loaded machines under transient conditions - selection of circuit breakers.

UNIT - III [Text Book- 1] (13)

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. Phase shift in STAR/DELTA transformer banks.

UNIT - IV [Text Book- 2] (13)

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 - V [Text Book- 2] (13)

Power system stability: Introduction – steady state stability, Transient stability, Review of machine swing equation - Equal area criterion of stability – applications.

Step by step solution of the swing equation - factors affecting steady state and transient stabilities.

Learning Resources:

Text Books:

1) W D Stevenson Jr Elements of power system analysis, Fourth Edition, TMH International student edition
2) D.P. Kothari and I.J. Nagrath , Modern power system analysis, TMH 3rd edition 2004

Reference Books:

1) Kimbark Vol – I, Power system stability, Wiley Publications.
2) P. Kundur , Power system stability and control, TMH 1998.
3) A. R. Bergen and V. Vittal, Power System Analysis, Pearson Publication.

Web Resources:

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/powersystem/chapter_6/6_7.html %Reference for symmetrical faults
4. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/powersystem/chapter_8/8_1.html %Reference for Unsymmetrical faults
5. http://www.mkpalconsulting.com/files/stabilitybook.pdf %Reference for Power system stability

EE 309	POWER ELECTRONICS	L	T	P	C
		4	--	--	3

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. Analyze and 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, TRIAC triggering and turn off methods.

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- 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.

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).

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

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

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.

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 310	ELECTRICAL MEASUREMENTS &INSTRUMENTATION	L	T	P	C
		4	1	--	3

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 understand operation of C.T's and P.T's.
4. To make the student to understand the process of measuring resistance, inductance and capacitance during electrical engineering practice.
5. To discuss the layouts of digital instruments, transducers.

Course Outcomes:

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

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

COURSE CONTENT:

UNIT – I [Text Book- 1] (13)

Instruments: Classification – Deflecting, Controlling and Damping torques – PMMC, MI type instruments – Expression for torque equation

Extension of ranges using Shunts and Multipliers, Single phase and three phase dynamometer wattmeter, LPF and UPF

UNIT - II [Text Book- 1] (13)

Measuring Instruments: Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading, three phase energy meter.

Construction and operation of Power factor meters, Frequency meters, Synchroscopes

UNIT – III [Text Book- 1] (13)

Instrument Transformers: Need of instrument transformers, Principle of operation of C.T & P.T, Errors and testing.

Magnetic Measurements: Ballistic galvanometer, Calibration by Hibbert's magnetic standard, Flux meter, Determination of B-H curve.

UNIT – IV [Text Book- 1] (13)

Bridges: Maxwell's - Anderson's - Wien's - Schering's - Kelvin's double bridge. Measurement of high resistance by Price's guard wire, loss of charge methods.

Oscilloscope : Basic operation- deflection mechanism - time base circuits - vertical amplifiers - alternate and chop modes - applications.

UNIT - V [Text Book- 1] (13)

Digital Instruments: Advantages of Digital Instruments**,** Principle of operation of Ramp, Integrating and Potentiometric type DVM's - display devices LEDs and LCDs.

Transducers: Principles - LVDT - frequency and power transducers Measurement of Non electrical quantities with electrical transducers- Velocity & Acceleration, thermister,
thermo couple, displacement.

Learning Resources:

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney, 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.ac.in/courses/108105053/pdf/L-42(GDR)(ET)%20((EE)NPTEL).pdf
2. http://www.facstaff.bucknell.edu/mastascu/elessonshtml/Measurements/MeasIntro.htm
3.http://www.electrical4u.com/electrical-measuring-instruments-types-accuracy-precision-resolution-speed/

EE 311A	HIGH VOLTAGE ENGINEERING	L	T	P	C
Elective - 1		4	--	--	3

Course Objectives:

1. To provide sufficient knowledge about break down mechanism in gases.
2. To provide sufficient theoretical and analytical background to understand the concepts of Generation of High AC, High DC and High Impulse voltages.
3. To facilitate the student in theoretical and analytical background to understand the concepts of generation of high impulse voltages.
4. To gain the knowledge on how the generated high voltages and currents are measured by using different measurement techniques.
5. To provide sufficient knowledge on testing techniques of various high voltage electrical apparatus and the how the wavelets are used to find fault detection.

Course Outcomes:

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

1. Understand the concepts of break down mechanism in gases.
2. Gain the knowledge on how to generate of high AC, and DC voltages.
3. Facilitate the students about the concepts of Generation of high Impulse voltage and currents.
4. Understand various methods to measure the different high voltages and currents in high voltage laboratory and in field.
5. Understand various methods to test the 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.

UNIT-II **[Text Book-1&2] (12)**

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.

Generation Of High A.C Voltages cascade connection of transformers - resonant transformers-Tesla coil- numerical problems.

UNIT-III **[Text Book-2] (12)**

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-IV **[Text Book-1&2] (12)**

Measurement Of High Voltages and currents: General concepts of High voltage measurements – series ammeter-generating voltmeters for the measure ment of DC voltages- voltage dividers

(Resistive, Inductive and Capacitive) for high DC,AC voltage and impulse voltage measurement.

High speed Oscilloscope - peak voltmeter and Sphere gap. Use of fibre optic for the measurement of AC current-various shunts used for measuring DC current, and impulse currents.

UNIT-V **[Text Book-1&2] (12)**

Corona: Corona - factors affecting corona - critical voltages and power loss - Radio interference due to Corona.

High Voltage Testing Techniques: Testing of insulators – Bushings - isolators and CB's - Testing of transformers, Fault detection using Wavelets-theoretical aspects.

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,4th edition,2009.

Reference Books:

1. CL Wadhwa-"High voltage engineering",New age International,Third edition,2010.
2. J.D. Craggs&Meak-"High Voltage Laboratory techniques", Butter Worthsscientific publications, London,1954.
3. Rakesh Das Begamudre-"Extra High Voltage AC transmission Engineering"New Age International,3rd edition,2006.
4.Adolf J. Schwab -."High Voltage measurement techniques",M.I.T Press 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

EE 311B	OPERATIONS RESEARCH	L	T	P	C
Elective - 1		4	--	--	3

COURSE OBJECTIVES:

1. To grasp the methodology of OR problem solving.
2. To understand and differentiate deterministic/probabilistic/stochastic static/dynamic problem solving situations.
3. To develop formulation skills in building models
4. To understand the basics in the field of queuing and game theory
5. To be able to understand and interpret solutions with simulation and decision theory

LEARNING OUTCOMES:

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

1. Develop the skills to consider real-world problems and determine whether or not linear programming is an appropriate modeling framework
2. Develop linear programming models that consider the key elements of the real world problem
3. Interpret the models' solutions and infer solutions to the real-world problems, solve transportation and assignment problems.
4. Explain the basics in the field of queuing models and Game theory.
5. Know when simulation and decision theory can be applied in real-world problems.

UNIT - I **[Text Book – 1] (12)**

Linear Programming: Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, duality, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.

UNIT - II **[Text Book – 1] (12)**

Transportation Problem: Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method. Finding optimal solution by MODI method, degeneracy, unbalanced transportation matrix and Maximization in transportation model.

Assignment Problem: One-to-one assignment problem, optimal solution, unbalanced assignment matrix. Flight scheduling problems, Traveling salesman problem.

UNIT - III **[Text Book – 1] (12)**

Queuing Theory: Queuing systems and their characteristics. Analysis of Markovian chains, Transition diagram, M/M/1 : FCFS/ α / α and M/M/1 : FCFS/ α / N queuing models.

Theory of games: Introduction, Rectangular two person zero person games, solution of rectangular games in tems of mixed strategies , solution of 2x2 games without saddle points, concept of dominance to reduce the given matrix , graphical method for 2xn and mx2 games

UNIT - IV **[Text Book – 1] (12)**

Simulation: Definition and applications. Mantel Carlo simulation. Random numbers and random number generation: Mixed congruential method, additive congruential method and multiplicative congruential method. Application problems in queuing and inventory.

UNIT – V **[Text Book – 1] (12)**

Decision Theory: Introduction , decision under certainty , Decision under risk- expected value criterion , expected value combined with variance criterion , decision under uncertainity , decision tree.

Learning Resources:

Text Books:

1. Operations Research – H.A. Taha , Pearson , 7th Edition, June 2002.
2. Introduction to Operations Research – Hiller and Liberman , MGH , 7th Edition , 2002.
3. Operations Research – R. Pannerselvam , PHI , 2nd Edition, 2006.
4. Quantitative techniques for management – V.Vohra , TMH , 3rd Edition.

Reference Books:

1. Introduction to Operations Research – Phillips, Ravindran, James Solegerg Wiley 1976.
2. Optimization Theory and Applications – S.S. Rao, Wiley 1979.
3. Operations Research – S.D. Sharma, Kedarnath Ram nath& Co, 11thEdition , 2002.
4. Operations Research – Gupta and Hira , S. Chand , 2008.

Web References:

1. http://www2.informs.org/Resources/
2. http://www.mit.edu/~orc/
3. http://www.ieor.columbia.edu/
4. http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
5. http://www.wolfram.com/solutions/OperationsResearch/

EE 311C	DIGITAL SIGNAL PROCESSING	L	T	P	C
Elective - 1		4	--	--	3

Course Objectives:

1. To provide sufficient theoretical, analytical background about 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 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. Get familiarity with discrete time signal processing and characterization of random signals filter design techniques.
2. Learn how to calculate the discrete Fourier series, Fourier transform for discrete time systems and discrete Fourier transform using FFT algorithms.
3. Learn the theory of modern digital signal processing and digital filter design, including window's techniques involving digital filter design.
4. Connect the course content to real time applications in various electrical and electronics engineering applications.
5. Expertise the fundamental principles, techniques of digital signal processing for understanding, designing new digital signal processing systems and for continued learning.

COURSE CONTENT:

UNIT – I (TEXT BOOK-1 & REFERENCE BOOK-1) (12)

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 differential equations using one sided z- transform.

UNIT – II (TEXT BOOK-1 & REFERENCE BOOK-1) (12)

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) (12)

IIR FILTER DESIGN TECHNIQUES: Introduction, Properties of IIR filters, comparison between Analog and Digital 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) (12)

FIR FILTER DESIGN TECHNIQUES: Introduction to characteristics of linear phase FIR filters, Frequency response, Design of FIR filters using Fourier series method.

Design of FIR filters using windowing methods: Rectangular window, Bartlett triangular window, Hanning window, Hamming window, Blackman window, Comparison of IIR and FIR filters.

UNIT – V (TEXT BOOK-1 & REFERENCE BOOK-1) (12)

REALISATION OF DIGITAL IIR FILTERS: Direct, Canonic, Cascade, Parallel realizations.

REALISATION OF DIGITAL FIR FILTERS: Direct, Cascade, 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. http://nptel.ac.in/video.php?subjectId=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#

EE 311D	POWER SYSTEM DEREGULATION	L	T	P	C
Elective - 1		4	--	--	3

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. Understand of operation of deregulated electricity market systems
2. Explain different electricity market mechanisms
3. Understand typical issues in electricity markets
4. Analyze power market.
5. Analyze various types of 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.

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

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 IV **[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 V **[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/

EE 312A	ELECTRICAL MACHINE DESIGN	L	T	P	C
Elective - 1		4	--	--	3

COURSE OBJECTIVES:

1. To elucidate students on the Principles of Design of static and rotating machines.
2. To enable the students to have a fair knowledge on design of cooling system of transformers, main dimensions of static and rotating machines, field coil, stator and rotor.

COURSE OUTCOMES:

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

1. Understand the basic concepts of electrical machine design and the principles of computerized design of electrical machines
2. Understand the specifications and design of main dimensions of transformer, cooling systems
3. Comprehend the design of dc machine and performance calculations
4. Gain knowledge on design of induction motor stator & rotor
5. Gain knowledge on design of synchronous machine (both. Salient pole & non-salient pole)

COURSE CONTENT:

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

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] (12)

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 transformer tank with tubes.

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

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] (12)

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.

UNIT –V [Text Book -1 & 4] (12)

Synchronous Machines (salient pole**):** 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.K. Sawhney, A Course in Electrical machine Design, Dhanpatrai & Sons,
2. M.G. Say, Performance and Design of AC Machines ,CBS.

Reference Books:

1. CEDT Manual on design and technology on low power transformers and inductors by IISC, Bangalore.
2. V.N.Mittle, Design of Electrical Machines, Standard Publishers Distributors2009.
3. A.E. Clayton Performance and Design of AC Machines.
4. R.K. Agarwal, Principles Of Electrical Machine Design, S.K.Kataria&Sons,2010.
5. M. Ramamoothy, Computer aided design of electrical equipment, Affiliated East West press Pvt Ltd New Delhi.

Web Resources:

1. http://www.faadooengineers.com/threads/9454-Electrical-Machine-Designfull-notes-e-books-pdf-all-units
2. http://nptel.iitm.ac.in

EE 312B	ANN AND FUZZY SYSTEMS	L	T	P	C
Elective - 1		4	--	--	3

Course Objective:

1. To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems
2. The goal of this course is to give a good basic understanding of Neural Networks and Fuzzy Logic.

Course Outcomes:

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

1. Get concepts of feed forward and feedback neural networks.
2. Acquire concept of fuzziness involved in various systems.
3. Get adequate knowledge about fuzzy set theory
4. Have comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
5. Attain adequate knowledge of application of fuzzy logic control to real time systems.

COURSE CONTENT:

UNIT – I **[Text Book 1]** **(12)**

Artificial Neural Network: Concept – evolution – basic models – Notation and terminology – training

Supervised learning Network: Introduction – Perceptron networks – Adaptive linear neuron – Multiple adaptive linear neurons – Back propagation network – radial basis network

UNIT–II **[Text Book 1]** **(12)**

Associative Memory Networks: Training algorithms for pattern association – Auto associative memory network – Bidirectional associative memory – Hopfield networks – Iterative auto associative memory networks – Temporal associative memory network

Unsupervised learning networks: Fixed weight competitive nets – Kohenenself organizing feature maps – learning vector quantization – counter propagation networks – Adaptive resonance theory network.

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

Fuzzy logic: Classical sets – fuzzy sets – classical relations – fuzzy relations – tolerance and equivalence relations – Membership functions

Fuzzification and Defuzzification: Fuzzification – Membership value assignments – Defuzzification – Fuzzy arithmetic – Fuzzy measures – Fuzzy rule base and approximate reasoning – fuzzy decision making.

UNIT – IV **[Text Book 1]** **(12)**

Hybrid fuzzy neural networks: Hybrid system – fuzzy logic in learning algorithms - fuzzy neurons - Neural networks as pre-processors, post processors, tuners

FNN architecture based on back propagation – ANFIS.

UNIT – V **[Text Book 1]** **(12)**

Neural network applications: Process identification, control, fault diagnosis and load forecasting.

Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

Learning Resources:
Text Books:

1. Rajasekharan and Pai, Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications – PHI Publication.
2. Chennakesava R Alavala,Fuzzy logic and Neural networks: Basic concepts and applications by New Age International (P) Ltd., 2008

Reference Books:

1. James A Freeman and Davis Skapura, Neural Networks –Pearson Education, 2002.
2. Simon Hakins ,Neural Networks –Pearson Education
3. C.Eliasmith and CH.Anderson,Neural Engineering - PHI
4. Bart Kosko,Neural Networks and Fuzzy Logic System, PHI Publications.
5. S.N.Sivanandam, S.N.Deepa, Principles of soft computing - John Wiley India – 2007

Web Resources:
1. http://users.abo.fi/rfuller/nfs.html
2. http://www.rejinpaul.com/2012/04/ic2403-neural-networks-and-fuzzy-logic.html
3. www.neptel.iim.ac.in
4. http://en.wikipedia.org/wiki/Artificial_neural_network
5. http://machine-learning.martinsewell.com/ann/
6. http://neurosci.wikidot.com/artificial-neural-network

EE 312C	RENEWABLE ENERGY RESOURCES	L	T	P	C
Elective - 1		4	--	--	3

COURSE OBJECTIVES:

1. To know the depletion rate of conventional energy resources and importance of renewable energy resources.
2. To know the importance of Energy Storage Devices.
3. To know alternate viable energy sources to meet the energy requirements.
4. To discuss about solar energy, wind energy, tidal energy and geothermal energy as alternate resources.

COURSE OUTCOMES:

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

1. Know the national scene of energy production, utilization, consumption and energy storage systems.
2. Understand about the basics of solar energy, collectors & generation of electricity from solar energy &photovoltaic's.
3. Understand the assessment of wind energy potential, wind turbines and wind generators.
4. Know about ocean energy, temperature differences & principles, extraction of energy from waves.
5. Understand about geothermal, types & how biogas is produced & digester for power generation.

COURSE CONTENT:

UNIT – I [Text Book- 1&2] (12)

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, Ref Book- 1](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 [Ref Book- 1] (12)
Energy from Oceans: Ocean temperature differences - principles of OTEC plant operations.
Wave energy: devices for energy extraction - tides - simple single pool tidal system, two pool tidal system.

UNIT-V [Ref Book-1, Text Book- 1](12)
Geothermal Energy: Origin and types: Hydrothermal, Geo-pressurized & Petro thermal.
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. EL-Wakil"Power Plant Technology" McGraw-Hill Publications.

Reference Books:

1. G.D.Rai"Non-Conventional Energy Sources"Khanna Publishers.
2. Abbasi&Abbasi"Renewable Energy Sources" Their impact on global warming and pollution by – PHI.

Web Resources:

1. http://www.tn.gov.in/spc/tenthplan/CH_11_2.PD
2. http://bieap.gov.in/Nonconventionalenergysources
3. http://www.em-ea.org/Guide%20Books/book 4/4.12App%20of%20Non%20conventional

EE 312D	ORGANISATIONAL BEHAVIOR	L	T	P	C
Elective - 1		4	--	--	3

COURSE OBJECTIVES

1. To enhance the understanding of the dynamics of interactions between individual and the organization.
2. To facilitate a clear perspective to diagnose and effectively handle human behavior issues in Organizations
3. To develop greater insight into their own behavior in interpersonal and group, team, situations
4. To understand and manage organizational change and organizational conflicts poses challenges before the organization and the manager
5. To study the basis of shared norms beliefs and understanding that members have about the organization

COURSE OUTCOMES:

At the conclusion of the course it is expected that students will demonstrate knowledge and skills in several core areas. Specifically, students should be able to:

1. Identify key theoretical aspects and practical applications of organizational behavior.
2. Apply OB concepts and theories to analyze and improve work situations.
3. Understand and leverage your own traits and OB competencies in the workplace for professional success and as a potential organizational leader.
4. Understand the causes pressurizing change study the systems model of change and identify the importance of accurate organizational diagnosis.
5. Examine the concept of organizational culture and development by exploring how organizational cultures are formed and techniques of organizational development.

COURSE CONTENT:

UNIT – I: [Text Book1] (12)

Organisational Behavior: Meaning, nature and scope – Key elements in O.B. Challenges and opportunities for O.B. – Contributing disciplines to O.B. – O.B. Model.

UNIT –II: [Text Book1] (12)

Individual: Perception – Process, factors influencing perception, barriers in perceptual accuracy, enhancing perceptual skills. Learning – characteristics, theories and principles of learning.
Personality – Stages of Development, determinants of personality, theories of personality – Values and Attitudes and their relevance in O.B. context.

UNIT – III: [Text Book1] (12)

Group Dynamics: Meaning and types of groups, Dynamics of group formation, frame work of group behavior.
Developing interpersonal skills – Transactional Analysis and Johari Window.

UNIT – IV: [Text Book1] (12)

Organisational change: Change dimensions, change process, pressures for change, resistance to change, overcoming resistance to change, change management.
Organisational conflicts – Meaning, conflicts at individual, group and organisational level, sources of conflicts, functional and disfunctional aspects, stimulating productive conflict, strategies for conflict resolution.

UNIT V: [Text Book1] (12)

Organisational Culture: Definition and characteristics, creating and sustaining culture.
Organisational Development: Definition, characteristics, objectives and techniques of Organisational Development.

Learning Resources:

Text Books:

1. Fred Luthans, Organisational Behaviour, Tata McGraw Hill, 12th Edition.
2. Stephen P.Robbins, Organisational Behaviour, Pearson Education, New Delhi, 2006.

Reference Books:

1. Abraham.K.K. Organisational Behaviour, Prentice Hall of India, New Delhi.
2. Aswathappa.K. Organisational Behaviour, Himalaya Publishing House, New Delhi.
3. Donald R.Brown& Don Harwey, An Experimental Approach to Organisational Development, Pearson Education.
4. UdaiParek, Understanding Organisational Behaviour, Oxford.
5. Archana Tyagi, Organisational Behaviour, Excel Books, New Delhi.
6. P.Subba Rao, Management of Organisational Behaviour, Himalaya Publishing House, New Delhi.

Web Resources:

1. http://study.com/academy/course/organizational-behavior-course.html
2. http://nptel.ac.in/courses/110105033/

EE 354	ELECTRICAL MEASUREMENTS & INSTRUMENTATION LAB	L	T	P	C
		--	--	3	2

COURSE OBJECTIVES:

1. To know the procedures for measuring Resistance, Inductance and Capacitance of different ranges and dielectric strength of transformer oil.
2. To perform experiments to measure three phase power, frequency, core losses.
3. To conduct experiments for calibration of energy meter and LVDT.

COURSE OUTCOMES:

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

1. Measure various electrical engineering parameters and quantities used in engineering practice.
2. Calibrate the operation of Energy meter
3. Calibrate LVDT for measuring distance
4. Understand the dielectric strength transformer oil by using testing kit
5. Measure three phase power, frequency and core losses

LIST OF EXPERIMENTS:

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 δ measurement.
4. Anderson Bridge – inductance measurement.
5. Measurement of 3-phase active and reactive power in three phase circuits.
6. Measurement of strain using strain gauge.
7. Estimation of iron losses from B-H curve using CRO.
8. LVDT characteristics, calibration and displacement measurement.
9. Energy meter calibration by phantom loading.
10. Frequency and capacitance measurement by Wein's Bridge.
11. Measurement of medium resistance using Wheatstone bridge.
12. Determination of transformer ration and phase angle error using current transformer or potential transformer.
13. Measurement of dielectric strength of transformer oil by transformer oil testing kit.
14. Measurement of R, L, C using digital LCR meter.
15. Measurement of 1-phase power using 3-voltmeter and 3-ammeter method.

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

LEARNING RESOURCES:

TEXTBOOK:

1.A.K.Shawney,"A Course in Electrical & Electronic Measurement & Instruments ",DhanpatRai& Co 17th edition 2015.

Web references

1. http://www.eee.griet.ac.in/wp-content/uploads/2014/12/EMI-Lab-Manual.pdf
2. http://www.iare.ac.in/sites/default/files/lab2/MEASUREMENTS%20NEW.pdf
3. http://www.srmuniv.ac.in/sites/default/files/files/MeasurementsandControlSystemLab-EE0311.pdf

EE 355	CONTROL SYSTEMS LAB	L	T	P	C
		--	--	3	2

COURSE OBJECTIVES:

1. To enable the students to gain the knowledge on servo mechanism of motors and transfer function of dc generator and motors.
2. To facilitate the students about the proportional, integral, derivative controllers and advanced controllers such as stepper motor controller and programmable logic controllers.

COURSE OUTCOMES:

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

1. Gain knowledge on servo mechanism of motors and derive transfer function of dc generator and motors.
2. Understand the time response of second order system with proportional, integral and derivative controllers
3. Gain the knowledge on advanced controllers such as stepper motor controller and programmable logic controllers.
4. Understand lag & lead networks.
5. Know the frequency response of first and second order systems.

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. Programmable Logic Controller.
14. P, PI, PD, PID control using Op-Amps.
15. Frequency response of first and second order systems.

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. M.Gopal-“Control systems principles and design”,Tata McGraw-Hill Education Pvt. Ltd,New Delhi,8 th reprint,2006
2. A.NagoorKani-“Control systems”, RBA Publications, Second Edition,2006

Web references:

1. https://www.site.uottawa.ca/~rhabash/ELG4152LN01.pdf
2. http://www.cds.caltech.edu/~murray/books/AM08/pdf/am07-complete_17Jul07.pdf
3. https://www3.nd.edu/~pantsakl/Publications/348A-EEHandbook05.pdf

EE 356	ELECTRICAL WORKSHOP PRACTICE LAB	L	T	P	C
		--	--	3	2

COURSE OBJECTIVES:

1. To understand the functioning of various electrical appliances used in domestic purpose.
2. To gain the knowledge on faults location of cables &measurement harmonic distribution in electrical equipment.
3. To estimate the equipment of wiring in houses & industries.

COURSE OUTCOMES:

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

1. Understand and study of electrical equipment like fan, refrigerator etc.
2. Study and understand the faults by using fault analyzer.
3. Study about substations layout and Transfomers.
4. Identify the parts in ceiling fans and fluorescent lamp etc.
5. Understand earthing method and estimation of industrial hall wiring.

LIST OF EXPERIMENTS:

1 Assembling and testing of ceiling fan
2. Assembling and testing of various components of fluorescent lamp
3. Underground cable and Location of cable fault by using cable fault analyzer.
4. Measurement of total harmonic distortion by using harmonic analyzer
5. Design of house wiring &estimation of material.
6 Location of hotspot in electrical equipment by using thermal cameras
7. Identification of Vector group testing of a 3-phase transformer
8. Determination of turns ratio error &transformation ratio error by using Silbees method. (Transformation ratio test kit)
9. Assemble of single phase transformer.
10. Substation layout.
11 Estimation of wiring for industrial hall.
12 Study of various starters for various induction motors.
13 Trouble shooting of home appliances.
14 Manufacturing of choke coil.
15. Assembling of earth pit& earth connections for electrical equipment**.**

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

Learning Resources:

1. B. L. Theraja, A. K. Theraja, A Textbook of Electrical Technology Vol – III S. Chand Publishers., New Delhi.
2. K. B. Bhatia Fundamentals of Maintenance of Electrical Equipments Khanna Publishers.
3. K. Manjunath, Electrical installation and estimation, Falcon Publishers, 4th edition, 2013.

Web References:

1.https://www.quia.com/files/quia/users/s3saleem/ElectricalWorkshop/Module1/Module_1.pdf
2.http://ggnindia.dronacharya.info/EEEDept/Downloads/Labmanuals/3rd_Semester/EE_WORKSHOP.pdf
3. https://www.scribd.com/doc/147841622/Engineering-Practice-Lab-Manual-Electrical-and-Electronics

EE 401	SWITCH GEAR & PROTECTION	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

1. To provide students with strong foundation on the protective relays and circuit breakers used for the protection of various electrical apparatus in the power system network.
2. To facilitate the students to have a fair knowledge on necessity of grounding for electrical equipment and performance of various static relays.

COURSE OUTCOMES:

1. Upon successful completion of the course, the student will be able to:
2. Get an idea of zones of protection and working principle of various types of electromagnetic relays.
3. Get the knowledge on distance protection and understand the concept of arc quenching phenomenon in circuit breaker
4. Understand the working principle of various circuit breakers with their specifications and applications.
5. Get the knowledge of differential protection of various power system network elements and to understand the concept of grounding, soil resistivity and earth resistance.
6. Gain the knowledge and working principle of static relays and their applications.

COURSE CONTENT:

UNIT – I **[Text Book- 1] 12**

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.

UNIT – II **[Text Book- 1&2] 12**

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.

Switchgear: Elementary principles of arc phenomenon - arc quenching - interruption of capacitive currents and low current chopping - resistance switching - recovery and restriking voltages.

UNIT – III **[Text Book- 1&2] 12**

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 – IV **[Text Book- 1 &2] 12**

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 – V **[Text Book- 1 & Reference Book – 1] 12**

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. BadariRam , D.N Viswakarma, Power System Protection and Switchgear, TMH Publications
2. C.L. Wadhwa, Electrical power systems, New age International (P) Limited
3. Y.G. Paithankar&S.R.Bhide, Fundamentals of Power System Protection, PHI, 2003

Reference Books:

1. T.S. MadhavaRao, Power system protection Static relays, TMH 2nd edition 1981
2. Mason, The Art and Science of protective relaying, Wiley Eastern Ltd
3. B. Ravindranath, Chander Power system protection and switchgear, Willy Eastern Ltd 1992
4. Sunil S. Rao, Switchgear and protection, Khanna Publications

Web References:
1. www.electrical4u.com
2. .http://www.cdeep.iitb.ac.in/nptel/Electrical%20Engineering/Power%20System%20Protection/
3. http://www.electrical-installation.org/
4. http://electrical-engineering-portal.com/introduction-to-static-protection-relays

EE 402	COMPUTER APPLICATIONS TO POWER SYSTEMS	L	T	P	C
		4	1	--	3

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:

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

1. Acquire the knowledge of analyzing power system network to get the primitive data with and without mutual coupling
2. Acquire knowledge to write performance equations and able to develop network matrices.
3. Able to represent a three phase network for balanced and unbalanced excitations, short circuit studies.
4. Able to design a power plant with different load flows.
5. Able to develop an algorithm for transient stability study and able to write state equations for turbine and speed governor controls.

COURSE CONTENT:

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

Formation of Incidence 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.

UNIT - II [Text Book- 1&2] (12)

Formation of network matrices: Network performance equations - formation of network matrices using singular &non singular transformation

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.

UNIT – III [Text Book- 1] (12)

Short circuit studies:

Representation of three phase network elements for balanced and unbalanced systems.

Short circuit calculations for symmetrical and unsymmetrical faults using bus impedance matrix.

UNIT – IV [Text Book- 1&2] (12)

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 - V [Text Book- 1& Reference book-3] (12)

Formulation of transient stability problem:

Representing synchronous machine by constant voltage behind transient reactance (d- axis) and network by steady state equations - alternating solution approach for transient stability solving algebraic equations and differential equations alternately -combined solution approach. Flow chart for digital simulation of transient stability problem.

Development of state equation (linearised version) for steady state stability of power systems with single machine connected to infinite bus using swing equation for the machine and incorporating excitation (IEEE, 1981) turbine and speed governor controls.

Learning Resources:

Text Books:

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

Reference Books:

1. O.I.Elgerd, Electric Energy systems Theory, Tata McGraw-hill Publishing Company Ltd., second edition 1983.
2. Anderson &Fouad, Control and stability of Power Systems, Iowa state university press.
3. Nagrath&Kothari, Modern power system analysis, TMH 3rd edition.
4. M.A. Pai,Computer Techniques in Power System Analysis, TMH 2005.
5. P. Kundur, Power System Stability & Control, TMH 1998.

Web Resources:

1. http://nptel.ac.in/courses/108107028/
2.http://www.myopencourses.com/subject/computer-aided-power-system-analysis-2

EE 403	MOOCS (MASSIVE OPEN ONLINE COURSES)	L	T	P	C
		--	--	--	0

MOOCS (Massive Open Online Courses) Requirements:

- Enrollment of MOOCS course will be initiated from the date of commencement of class work for III Year I Semester.
- MOOCS course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.
- List of organisations offering MOOCS course(s) will be announced by the respective Board of Studies at the time of commencement of class work for III Year I Semester.

CE 404A Elective-III	BASIC SURVEYING [OPEN ELECTIVE]	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To study about the various surveying instruments.
2. To study the basics of chain survey in linear measurements.
3. To determine the relative positions of the existing features on the ground.
4. To obtain basic knowledge on Total Station.
5. To acquaint with procedures of leveling by dump level & auto level.

COURSE OUTCOMES:

By the end of the course surveying-I, the students will be able

1. To Know about the various surveying instruments.
2. To determine the relative positions of a point on the existing ground by conducting the survey.
3. To use all basic surveying instruments.
4. To operate Total Station instrument.
5. To take the levels of existing ground and to determine the reduced levels.

UNIT I **Surveying Vol. I by Dr. K. R. Arora (12)**

Surveying & Measurements: Definitions; Classification; Principles of Surveying; Basic measurements in surveying; Instruments used for different measurements; Units of measurement (linear & Angular); Plan and map; Scales used for Maps and plans; Phases of survey work and Duties of a surveyor. Procedures for distance measurement - Ranging, Chaining/taping a line.

UNIT II **Surveying Vol. I by Dr. K. R. Arora (12)**

Chain Surveying: Principle of Chain surveying; Basic definitions; Well-Conditioned & Ill-Conditioned triangles; Selection of stations and survey lines; Procedure of Field Work in Chain Surveying; Off-sets; Booking the survey (Field Book); Conventional Symbols; Problems encountered in chaining; Obstacles in chain Surveying.

UNIT III **Surveying Vol. I by Dr. K. R. Arora (12)**

Compass Surveying: Angles and Bearings; Instruments used to measure angles and bearings; Designation of Bearings; Fore and Back Bearings; Calculation of Included Angles from Bearings and Bearings from Included Angles; Prismatic & Surveyor's Compass; Magnetic Dip & Declination; Local Attraction and Corrections.

UNIT IV **Surveying Vol. I & II by Dr. K. R. Arora (12)**

Theodolite Surveying: Types of Theodolites; Vernier Theodolite - Essential Parts; Basic definitions; Temporary adjustments; Field operations - Measurement of horizontal angles(Repetition & Reiteration), vertical angles.

Total Station: Introduction; components of Total Station; Types of Prisms and targets used in total station; various advantages of Total Stations.

UNIT V **Surveying Vol. I by Dr. K. R. Arora (12)**

Simple Leveling: Basic definitions; Curvature and Refraction; Different methods of leveling; Levels - Dumpy level, Tilting level, Auto level; Leveling staff; Level field book; Booking and reducing levels; Classification of direct differential leveling methods -Fly leveling, Check leveling, Profile leveling and Cross sectioning, Reciprocal leveling and Precise leveling; Sources of errors & Difficulties in leveling.

LEARNING RESOURCES:

TEXT BOOKS:

1. Surveying Vol. I & II by Dr. K. R. Arora,11th Edition, Standard Book House,2012.
2. Surveying Vol. I & II by S K Duggal, 4th Edition, McGraw Hill Education (India) Private Limited, 2013.

REFERENCE BOOKS :

1. Surveying Vol. I&II by B.C. Punmia, Laxmi Publications,2005.
2. Surveying and Levelling by N.N Basak, McGraw Hill Education (India) Private Limited,2014.
3. Plane Surveying by AM Chandra, 2nd Edition, New Age International (P) Ltd.,2006.

WEB REFERENCES:

1. http://nptel.ac.in/courses/105104101/
2. http://nptel.ac.in/courses/105107121/
3. http://nptel.ac.in/courses/105107122/

CE 404B Elective-III	BUILDING MATERIALS & ESTIMATION [OPEN ELECTIVE]	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1 To teach the basics involved in selection of good quality building materials for construction
2 To give knowledge about various building elements and their specifications
3 Presents the basics of planning strategies, building bye laws and acoustics of building
4 preparing tender notice and various approvals needed for a project
5 Valuation of building and rent fixation

COURSE OUTCOMES:

At the end of this course,

1 Students are familiar with various building materials
2 Students knows about various building elements and their specifications
3 Students are familiar with types of masonry works and bonds used in construction
4 Students are capable of understanding building plan and have knowledge about building rules, bye-laws and building elements
5 Students will have knowledge about Valuation of building and rent fixation

UNIT – I **(12)**

Clay bricks: Brick clay, Preparation of bricks, Types of bricks, Dimensions of bricks, Weight of bricks, Storing of bricks, Brick substitutes, Classification of bricks, Tests for bricks.
Timber: Classification of trees, Structure of wood, seasoning and con-version of timber, Market forms of timber, Defects of timber, Treatment of timber, Classification of timber.
Glass: Manufacture and Classification, Treatment of glass, Uses of glass, testing for quality, Characteristics and Performance of glass, Glass fibre.
Plastics: Classification of plastics, Properties of plastics, Fabrication of plastic articles, some plastics in common use, Reinforced plastics.

UNIT-II **(12)**

Cement: General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, Hydration of cement, heat of hydration, structure of hydrated cement.
Types of Cements: Ordinary Portland cement, low alkali cement, Rapid hardening cement, Sulphate resisting cement, Portland blast furnace slag cement, Portland pozzolana cement, air entraining cement, white cement, hydro phobic cement, oil well cement, low heat Portland cement.

UNIT-III **(12)**

Building Rules and Bye-Laws: Zoning regulations; Regulations regarding layouts or sub-divisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index.
Building Elements: Conventional signs; Guidelines for staircase planning; Guidelines for selecting doors and windows; Terms used in the construction of door and window; Specifications for the drawing of door and window.

UNIT-IV **(12)**

Analysis of Rates : Task or out – turn work; Labour and materials required for different works; Rates of materials and labour; Preparing analysis of rates for the following items of work:
i) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering v) CC flooring vi) White washing.
PWD Accounts and Procedure of Works : Organization of Engineering department; Work charged establishment; Contract; Tender; Tender notice; Tender Schedule; Earnest money; Security money;

Measurement book; Administrative approval; Technical sanction; Plinth area; Floor Area; Carpet area; Approximate Estimate; Plinth area estimate; Revised Estimate; Supplementary estimate.

UNIT –V **(12)**

Valuation: Cost; Price & value; Methods of valuation; Out goings; Depreciation; Methods for Estimating cost depreciation; Valuation of building.

Miscellaneous Topics : Gross income; Net income; Scrap value; Salvage value; Obsolescence; Annuity; Capitalized value; Years purchase; Life of structures; Sinking fund; Standard rent; Process of fixing standard rent; Mortgage.

LEARNING RESOURCES:

TEXT BOOKS:

1 Estimating & Costing in Civil Engineering by B.N. Dutta; UBS Publishers & Distributors, 2010.
2 Building Materials by P.C. Vergese, 1st Edition,PHI,2009.
3 Building construction by P.C. Vergese, 1st Edition ,PHI, 2009.

REFERENCE BOOKS:

1 Engineering Materials by Rangawala, Charotar Publications, Fortieth Edition: 2013
2 Building construction by BC Punmia et al., 10th Edition,Laxmi Publications, 2008.
3 Building planning, designing and scheduling by Gurucharan Singh,Standard book House, 2006.

WEB REFERENCES:

1 http://nptel.iitm.ac.in/courses.php
2 http://freevideolectures.com/Course/86/Building-Materials-and-Construction
3 http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv053-Page1.htm
4 http://bookmoving.com/register.php?ref=Building%20materials%20rangwala
5 http://bookmoving.com/book/building-materials_654.html

CH 404A Elective – III	ENERGY ENGINEERING [OPEN ELECTIVE]	L	T	P	M	C
		4	-	-	100	3

Course Objectives:

1. To provide the knowledge about formation, classification, ranking, analysis, testing, carbonization, gasification and liquefaction of coal, manufacture of cock.
2. To provide the knowledge about design, occurrence, composition, classification, exploration and production of petroleum, refining, testing and analysis of petroleum products.
3. To provide knowledge about the non -conventional energy resources sun and wind.
4. To provide knowledge about the non -conventional energy resources like ocean thermal, geothermal energy, biomass and fuel cells
5. To provide knowledge about the energy storage and related problems in the world and its solutions.

Course Outcomes:

1. An ability to understand the importance of environment and conservation of natural resources.
2. An ability to succeed in the competitive exams of energy industry.
3. An ability to utilize the non-conventional energies in place of conventional energies and its manufacture.
4. An ability to utilize the non- conventional energies in place of conventional energies and its manufacture.
5. An ability to maintain the sustainability in the environment

UNIT – I **(12)**

Conventional energy resources, the present scenario, scope for future development.

Coal: Origin, occurrence and reserves, classification, ranking, analysis and testing, coal carbonization, manufacture of coke, coal gasification, coal liquefaction.

UNIT – II **(12)**

Petroleum: Origin, occurrence and reserves, composition, classification, characteristics, exploration and production-.

Petroleum Refining:, petroleum products, testing and analysis of petroleum products, Refinery processes- Distillation, cracking, reforming and alkylation, polymerization& isomerization .

UNIT – III **(12)**

Non- conventional energy sources:
Solar energy**:** Solar energy, solar radiation, solar collectors-flat plate, concentrating (focusing and non- focusing) collectors , principles of heating and cooling, photo voltaic cells.

Wind energy**:** Basic principles, basic components, classification of WECS, types of wind machines (horizontal, vertical axis machines) Wind energy conversion systems- horizontal and vertical systems. Applications.

UNIT – IV **(12)**

Non- conventional energy sources:
Ocean thermal energy - introduction, OTEC (Closed and open OTEC cycles),applications. Geothermal energy- introduction, sources, hydrothermal resources (Liquid and vapor dominated systems), applications.

Bio-mass energy- Introduction, conversion techniques, classification and Types of biogas plants, Hydrogen energy-Introduction, hydrogen production, storage and applications. Fuel cells-introduction, classification, types, advantages and applications.

UNIT –V **(12)**

Energy storage: introduction, storage systems. Mechanical energy storage- pumped hydroelectric, compressed air, fly wheel storage. Electrical storage- lead acid battery. Chemical storage- via hydrogen, ammonia, chemical reactions. Thermal energy storage- latent ,sensible heat storage. Solar pond

Energy Conservation: Conservation methods in process industries, Theoretical analysis, practical limitations, equipment for energy saving / recovery- recuperators, regenerators, pipes and pumps.

TEXT BOOKS:
1. Non-conventional energy resources by G. D. Rai, Khanna Publishers(2004)
2. Engineering chemistry by Jain& Jain 15 th edition

REFERENCE BOOKS:
1. Conventional Energy technology by S.B.Pandy, Tata McGraw Hill (1987)
2. Elements of Fuels ,furnaces and refractories O.P.Gupta , Khanna publishers(2000)

CH 404B Elective – III	BIO - FUELS [OPEN ELECTIVE]	L	T	P	M	C
		4	-	-	100	3

Course Objectives:

1. To provide the knowledge about properties, composition, features of bio fuels and uses of biomass and their environmental impacts.
2. To provide the students a substantial knowledge of bio fuel production technologies.
3. To provide knowledge about the process of biogas production and methods of production of biodiesel and comparison of the standards to the conventional diesel.
4. To provide knowledge about the production of lipids, bio hydrogen from different bacteria and algae.
5. To provide knowledge about the fuel cell technology

Course Outcomes:

1. An ability to describe the functional principle of biofuel technologies in small and large scale.
2. An ability to describe the main steps and components in bioethanol, biodiesel and biogas production.
3. An ability to Participate actively in teamwork and work with case related problem solving.
4. An ability to work with professional problem solving in an industrial environment.
5. An ability to work in other fields of engineering.

UNIT – I **(12)**

Types of biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Composition of lignocellulose (lignin, hemi cellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of cellulose; trichodermacellulases; bacterial cellulases; and comparison with degradation of high starch crops.

Sources of energy, introduction of biofuels, availability of bio mass, composition of biomass, terrestrial biomass, aquatic biomass. Physical and chemical properties of biomass. Useful and undesirable features of biofuels.

UNIT – II **(12)**

Biogas: The substrate, the digester, the microorganisms, the process of bio gas production, factors affecting bio gas yields, advantages, disadvantages.

Bioethanol: Bioethanol vs. Petrol, production of bio ethanol, ethanol recovery. Bio butanol. Properties and standards of bioethanol. Lignocellulosic biomass composition and characterizations.

UNIT –III **(12)**

Sources and processing of biodiesel (fatty acid methyl ester); nature of lipids, especially fatty acids and triglycerides. Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodiesel (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO).

Engineering, economics and environmental issues of biodiesel; major policies and regulations pertaining to the production, distribution, and use of biodiesel. Comparison of bio diesel with conventional diesel. Standards of bio diesel, current technologies and challenges.

UNIT – IV **(12)**

Hydrogen Production - Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production - Storage of Hydrogen - Gaseous, Cryogenic and Metal hydride –

Bio hydrogen: Production of bio hydrogen from anaerobic bacteria, photosynthetic algae, photosynthetic–hydrogenase system. Pyrolysis, bio-oil upgradation,

UNIT – V **(12)**

Fuel cells: Enzymatic fuel cells, microbial fuel cells. Fuel Cell – Principle of working, construction and applications.

Fuels for Fuel Cells: Hydrogen, Hydrocarbon fuels, effect of impurities such as CO, S and others.

TEXT BOOKS

1. Robert C. Brown, “Bio renewable Resources: Engineering,” New Products from Agriculture, Wiley-Blackwell Publishing, 2003

REFERENCES:

1. Samir K. Khanal, “Anaerobic Biotechnology for Bioenergy Production: Principles and Applications,” Wiley-Blackwell Publishing 2008

2. Martin Kaltschmitt; Hermann Hofbauer.“Biomass Conversion and Biorefinery,” Springer Publishing, 2008**.**

CS 404A **JAVA PROGRAMMING**
Elective – III [OPEN ELECTIVE]

L	T	P	C
4	0	0	3

COURSE OBJECTIVES:

1. Understand the basic concepts and fundamentals of platform independent object oriented language.
2. Demonstrate skills in writing programs using exception handling techniques and multithreading.
3. Understand streams and efficient user interface design techniques.

COURSE OUTCOMES:

1. Use the syntax and semantics of java programming language and basic concepts of OOP.
2. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
4. Demonstrate how the java program communicates with the console and disk files using the concept of streams.
5. Design event driven GUI and web related applications which mimic the real word scenarios.

UNIT-I **(12)**

Introduction: The History and Evolution of Java, an Overview of Java.
Data Types, Variables, and Arrays: The primitive types, variables, type conversion and casting, Automatic Type Promotion in Expressions, Arrays, Operators, Control statements.
Introducing Classes : Class fundamentals, Declaring the objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this keyword, Garbage Collection, the finalize() Method.
A Closer Look at Methods and Classes: Overloading Methods, Using objects as Parameters, Returning Objects, Introducing Access control, Understanding static and final keywords, Nested and Inner Classes.

UNIT-II **(12)**

Inheritance: Inheritance Basics, Using super, Creating multilevel Hierarchy, When Constructors are executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, using final with Inheritance.
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Default Interface Methods, Use static Methods in an Interface.

UNIT-III **(12)**

String Handling: String class, String Buffer class.
Exception Handling: Fundamentals, Exception types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.

Multithreaded Programming : The Java Threaded Model, The Main Thread , Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter Thread Communication.

UNIT-IV (12)

I/O Basics: Streams, Byte streams, Character streams, Reading Console Input, Writing Console Output, Reading and Writing Files.
The Applet Class: Applet Basics, Applet Architecture, An Applet Skeleton, Simple Applet Display Methods, Requesting Repainting, The HTML APPLET Tag, Passing Parameters to Applets.

UNIT-V (12)

Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, The KeyEvent Class, Sources of Events, Event Listener Interfaces, Using The Delegation Event Model, Adapter Classes.
Introducing the AWT: Working with Windows, Graphics and Text, Using AWT Controls, Layout Managers and Menus.

TEXT BOOKS:

1. Java The Complete Reference 9th Edition, Herbert Schildt, Mc Graw Hill Education(India) Private Limited, New Delhi.

REFERENCE BOOKS:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Introduction to Java programming, By Y.Daniel Liang,Pearson Publication.

		L	T	P	C
CS 404B	**DATABASE MANAGEMENT SYSTEMS**	**4**	**0**	**0**	**3**
Elective – III	[OPEN ELECTIVE]				

COURSE OBJECTIVES:

1. To understand the fundamental concepts, historical perspectives, current trends, structures, operations and functions of different components of Databases.
2. To understand the types of integrity constraints in a relational database system and the concepts of SQL to create and access the database.
3. To understand basic concepts of ER model and database design using normalization process.
4. To understand concurrency, Recovery techniques.

COURSE OUTCOMES:

1. An understanding of basic concepts and use of various database systems.
2. An ability to enforce integrity constraints to maintain validity & accuracy.
3. An ability to write relational expressions for the queries.
4. An ability to design and develop a database using normalization theory.
5. An ability to use different concurrency control and Recovery techniques.

UNIT- I **(12)**

Databases and Database Users: Introduction - An Example - Characteristics of the Database Approach - Actors on the Scene - Workers behind the Scene - Advantages of Using the DBMS Approach.

Database System Concepts and Architecture: Data Models, Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs

UNIT- II **(12)**

Data Modeling Using the Entity-Relationship (ER) Model: Using High- Level Conceptual Data Models for Database Design - An Example Database Application - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints - Weak Entity Types

The Relational Data Model and Relational Database Constraints: Relational Model Concepts - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations.

UNIT-III **(12)**

SQL-99: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types - Specifying Constraints in SQL - Schema Change Statements in SQL - Basic Queries in SQL –

More Complex SQL Queries - INSERT, DELETE, and UPDATE Statements in SQL - Views (Virtual Tables) in SQL.

UNIT- IV **(12)**

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas - Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.
Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing - Transaction and System Concepts - Desirable Properties of Transactions – Characterizing Schedules Based on Recoverability -Characterizing Schedules Based on serializability.

UNIT – V **(12)**

Concurrency Control Techniques: Two-Phase Locking Techniques for Concurrency Control - Concurrency Control Based on Timestamp Ordering.
Database Recovery Techniques: Recovery Concepts – Recovery Techniques Based on Deferred Update - Recovery Techniques Based on Immediate Update - Shadow Paging.

TEXT BOOK:

1. "Fundamentals of Database Systems", Ramez Elmasri and SHamKanth B.Navate Pearson Education, 5th edition.

REFERENCE BOOKS:

1. "Introduction to Database Systems", C.J.Date Pearson Education.

2. "Data Base Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rdEdition.

3. "Data base System Concepts", Abraham Silberschatz, Henry.F.Korth, McGraw hill, 5th edition.

EC-404A Elective - III	APPLIED ELECTRONICS (OPEN ELECTIVE)	L	T	P	M	C
		3	1	-	100	3

COURSE OBJECTIVES:

1. To understand about various modern electronic systems.
2. To provide clear explanation of the operation of all the important electronic devices and systems available.
3. To know about modern audio and video systems.
4. To know about various Telecommunication Systems.

COURSE OUTCOMES:

1. Able to understand the working, types and applications of microphones and loudspeakers.
2. Able to understand the features of commercial, theatre sound recording and colour TV standards
3. Able to understand the working of various electronic systems, telecommunication and switching systems.
4. Able to understand the working of various applications like digital clocks, fiber optics, microprocessor and mobile radio systems.
5. Able to understand consumer electronic equipment and systems like washing machines

UNIT I **(12)**

Microphones: Characteristics of microphones, Types: Carbon microphones, moving coil microphones, ribbon microphones, electret microphones and wireless microphones. **Headphones:** Headphones and Headsets, Types of headphones.
Loud Speakers: Ideal loud speaker, **Types:** Crystal loudspeaker, electrostatic loudspeaker, permanent magnet loudspeaker, **High frequency loudspeakers:** Horn type tweeters, **Equalizers and Mixers.**

UNIT II **(12)**

Commercial Sound: Recording, manual synthesizer, programmed synthesizer, public address systems, speaker matching systems, PA-system characteristics. **Theatre Sound System**,
Color TV standards and Systems: Primary and secondary colors, Luminance signal, Chrominance signal, color TV camera tube, color TV picture tube, NTSC system PAL system SECAM system.

UNIT III **(12)**

Audio systems,, Video Systems, Remote Controls, Modulation Techniques, Carrier Systems, Telecommunication Systems: telephone receivers and handsets, signaling-CCITT NO7, modes of operation, **Switching Systems:** principle, Read relay and cross bar switching, PBX switching, stored program control.

UNIT IV **(12)**

Fiber Optics, Data Services, digital clocks, microprocessor, microcontroller, Mobile radio systems: wireless local loop (WLL), role of WLL, radio paging service, digital cellular block diagram, establishing a call, **Fascimile (FAX).**

(12)

UNIT V

IN-CAR Computers: Electronic ignition, electronic ignition lock system, ABS, Electronically controlled suspension (ECS), instrument pannel display, air-bag system. **Washing machines:** Electronic controller for washing machine, washing machine hardware, washing cycle, software and hardware development, **refrigeration systems**.

TEXT BOOKS:

S.P.Bali-Consumer Electronics-Pearson Education, ISBN: 9788131717592, first impression-2008.

REFERENCES:

1. Philip Herbert Hoff -Consumer Electronics for Engineers -Cambridge University Press (July 28, 1998), **ISBN-10:** 0521582075
2. Ronald K.Jurgen -Digital Consumer Electronics Handbook -(Editor) by McGraw Hill Professional Publishing, 1997. **ISBN-10:** 0070341435

WEB RESOURCES:

1.http://www.newagepublishers.com/samplechapter/000969.pdf
2.http://www.bits-pilani.ac.in:12354/qp1-9-10/EEE_C414_851_C_2009_1.pdf 3.http://nptel.iitm.ac.in

EC 404B Elective - III	BASIC COMMUNICATION (OPEN ELECTIVE)	L	T	P	M	C
		3	1	-	100	3

COURSE OBJECTIVES:

1. To understand an overview of communication systems.
2. To understand the modulation technique, need of modulation, Amplitude modulation.
3. To understand fundamentals of digital communications
4. To understand broadband communication systems and Television fundamentals.

COURSE OUTCOMES:

1. Able to understand transmission of analog signals using amplitude modulation.
2. Able to understand transmission of digital signals through PCM, PAM, PPM and DELTA Modulation techniques
3. Able to know about various Broad band communication systems.
4. Able to know about the monochrome and colour Television fundamentals.
5. Able to know about Optical communication systems.

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

Communications: Communications systems, Information, Transmitter, Channel, noise, Receiver, Modulation, Description, Need for modulation, Bandwidth Requirements.
Amplitude Modulation: Amplitude Modulation Theory, Frequency spectrum of the AM wave, Representation of AM, Power relations in the AM wave, **Generation of AM,** Basic requirements, comparison of levels, Grid modulated class C amplifier, Plat modulated class C amplifier, Modulated transistor amplifiers.

UNIT I I *Text Book -2* **(12)**

DIGITAL COMMUNICATIONS
Digital Communications: Digital Technology, Digital fundamentals, sampling theorem, aliasing effect, pulse amplitude modulation (PAM), synchronization in PAM systems, pulse time modulation, spectra of PDM and PPM systems, Elements of pulse code modulation (PCM), sampling and quantization, encoding, regeneration, decoding, DPCM, delta modulation.

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

Broadband Communications Systems: Multiplexing, Frequency division multiplex, Time – division multiplex, **Short and Medium Haul Systems**: Co-axial Cables, Fiber optic links, Microwave links, **Long Haul Systems**: Satellite Communications, **Elements of Long-Distance Telephony**, Routing codes and signaling systems, Telephone exchanges (switches) and routing.

Text Book - 3 **(12)**

UNIT IV

FUNDAMENTALS OF TELEVISION
Television Fundamentals: TV transmitter and receivers, synchronization, image continuity, interlaced scanning, flicker, picture resolution, horizontal and vertical sync details, number of scanning lines, scanning sequence details.
Essentials of colour television: colour perception, three colour theory, luminance, hue, saturation, colour difference signals.

UNIT V *Text Book - 1* **(12)**

OPTICAL COMMUNICATIONS

History and development, **nature of light:** reflection, refraction, dispersion, diffraction, absorption, scattering, Optical fiber losses, fiber cables, types of fibers.

TEXT BOOKS:

1. George Kennedy-Electronic Communication Systems -Tata McGraw-Hill Publishing , 5th Edition,2011
2. Simon HykinS, Communication Systems, 2nd Edition-reprint 2010
3. R.R. Gulati -Modern Television Practice – Principles, Technology and Service- New Age International Publication, 2009.

REFERENCES:

1. Simon HykinS-Introduction to Analog and Digital Communication. 2007
2. John M Senior – Optical Fiber Communications – An imprint of Pearson Education- 3rd Edition-2009

WEB RESOURCES:

http://web.engr.oregonstate.edu/~magana/ECE461-561/index.htm
http://www.ensc.sfu.ca/~jiel/courses/327/index.html
http://www.ece.utah.edu/~npatwari/ece5520/lectureAll.pdf
http://nptel.iitm.ac.in/syllabus/syllabus.php?subjectId=117105077

IT 404A	SOFTWARE ENGINEERING [OPEN ELECTIVE]	L	T	P	C
		4	0	0	3

Course Objectives

At the end of the course the students will understand

1. Basic concepts on Software Engineering methods and practices.
2. Software Process Models and Software Development Life Cycle.
3. Requirements analysis and design of software development.
4. Software Development life cycle for Web app.

Course Outcomes

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

1. Identify, formulate, and solve Software Engineering problems.
2. Elicit, analyze and specify software requirements for various stakeholders.
3. Familiar with Design, development, deployment and maintenance of a software project.
4. Familiar with Architecture design and User Interface design
5. Apply software engineering paradigms to web apps.

UNIT-I (12)

INTRODUCTION TO SOFTWARE ENGINEERING: The Evolving Role of Software, Software, The Changing Nature of Software, Legacy Software, Software Myths.

A GENERIC VIEW OF PROCESS: Software Engineering - A Layered Technology, A Process Framework, The CMMI, Personal and Team Process Models.

UNIT-II (12)

PROCESS MODELS: The Waterfall Model, Incremental Process Models, Evolutionary, Agile Process Model.

SOFTWARE ENGINEERING PRACTICE: Software Engineering Practice, Communication Practices, Planning Practices, Modeling Practices, Construction Practice, Deployment.

UNIT -III (12)

REQUIREMENTS ENGINEERING: A Bridge To Design and Construction, Requirements Engineering Tasks, Initiating the Requirements Engineering Process, Eliciting Requirements, Developing Use-cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

DESIGN ENGINEERING: Design within the Context of Software Engineering, Design Process and Design Quality, Design Concepts, The Design Model.

UNIT -IV (12)

CREATING AN ARCHITECTURAL DESIGN: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design.

PERFORMING USER INTERFACE DESIGN: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT -V (12)

INITIATING A WEBAPP PROJECT: Formulating Web-Based systems, Planning for Web Engineering projects

ANALYSIS FOR WEBAPPS: Requirements Analysis for WebApps, Analysis Model for WebApps, The Content Model, The Interaction Model.

Learning Resources:

Textbooks:

1. Roger S.Pressman, 'Software Engineering- A Practitioner's Approach', 6th Edition, McGraw- Hill International, 2009.

Reference Books:

1. Ian Sommerville, 'Software Engineering', 6th Edition, Pearson Education, 2014.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, 'Fundamentals of Software Engineering', 2nd Edition, PHI,2002.
3. RajibMall, 'Fundamentals of Software Engineering', 3rd Edition, PHI, 2013.

IT 404B **WEB TECHNOLOGIES** [OPEN ELECTIVE]

L	T	P	C
4	0	0	3

Course Objectives

At the end of the course the students will understand

1. Basic technologies to develop web documents.
2. Design web pages with css and apply scripting to web documents.
3. Design dynamic web pages with java script.
4. Concepts of xml.
5. Concepts of php and database access.

Course Outcomes

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

1. Apply technologies to develop web documents.
2. Design web pages with css and apply scripting to web documents.
3. Create dynamic web pages with java script.
4. Create valid and well-formed xml documents.
5. Write server side scripts with php and database access.

UNIT – I **(12 Periods)**

Fundamentals: A Brief introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The HTTP.

Introduction to XHTML: Origins and evolution of HTML, and XHTML, Basic Syntax, Standard XHTML, Document structures, Basic Text markup, images, hypertext links, lists, tables, forms, frames, syntactic differences between HTML & XHTML.

UNIT – II **(12 Periods)**

Cascading Style Sheets (CSS): introduction, levels of style sheets, style specification formats, selector forms, property value forms, font properties, list properties, color, alignment text, The Box model, Background images, the span and div tags.

The Basics of JavaScript: Overview of JavaScript, Object orientation and JavaScript, General Syntactic characteristics, primitives, operations and expressions, Screen output and keyboard input, control statements.

UNIT – III **(12 Periods)**

JavaScript: Object creation and modification, Arrays, Functions, An Example, Constructors, Pattern matching using regular expressions, Errors in scripts.

JavaScript and HTML Documents: The JavaScript Execution Environment, The Document Object Model, Element accessing in JavaScript, Events and Event Handling, Handling Events from Body elements, Handling events from Button elements, Handling Events from Text boxes and password elements, The DOM 2 Event model, The Navigator object.

UNIT – IV **(12 Periods)**

Dynamic Documents with JavaScript: Introduction, Element Passing, Moving Elements, Element Visibility, Changing colors and Fonts, Dynamic Content, Stacking Elements, Locating the mouse cursor, Reacting to mouse click, slow movement of elements, dragging and dropping elements.

Introduction to XML: Introduction, The syntax of XML, XML document structure, Document Type Definition, Namespaces, XML Schemas, Displaying Raw XML documents, displaying XML documents with CSS, XSLT Style sheets.

Unit-V **(12 Periods)**

Introduction To PHP: Origins and uses of PHP, Overview of PHP, General Syntactic Characteristics, primitives, Operations and Expressions, Output, Control Statements, Arrays, Functions, Pattern Matching, Form Handling.

Database Access through the web: Relational Databases, An Introduction to the Structured Query Language, The MYSQL Database System, Database Access with PHP and MYSQL.

Learning Resources:

TEXT BOOK:

1. Robert W. Sebesta "Programming the World Wide Web", 4/e Pearson Education.

REFERENCE BOOKS:

1. Harvey M. Deitel and Paul J. Deitel, "Internet & World Wide Web How to Program", 5/e, Pearson Education.
2. Jeffrey C. Jackson Web Technologies - A Computer Science Perspective, Pearson Education, 1st Edition.
3. Jason Cranford Teague, Visual Quick Start Guide CSS, DHTML & AJAX, Pearson Education, 4th Edition.

WEB REFERENCES:

1. www.wikipedia.com
2. www.w3schools.com
3. http://nptel.iitm.ac.in

ME 404A Elective- III	ROBOTICS [OPEN ELECTIVE]	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To provide an introduction to Robotics and Automation including robot classification, design and selection, analysis and applications in industry.
2. To provide information on various types of end effectors, their design, interfacing and selection.
3. To provide the details of operations for a variety of sensory devices that are used on robot , the meaning of sensing, classification of sensor, that measure position, velocity & acceleration of robot joint.
4. The goal of the course is to familiarize the students with the basic concepts of transformations performed by robot.
5. Familiarize students to perform kinematics and to gain knowledge on programming of robots.

COURSE OUTCOMES:

a. At the end of the course, students will be familiarized in basic components of robotics, classification of robots and their applications.
b. They will have knowledge on types of robot grippers, their usage and design considerations.
c. They attain knowledge on various types of sensory devices their working and applications.
d. Students will apply basic transformations related to the movement of manipulator.
e. An ability to design a robot mechanism to meet kinematics requirements and to write simple programs.

UNIT I **(12)**

Basics of Robot: Introduction to Robotics, major component of a robot, robotic like devices, classification of robots - Classification by coordinate system and by control method, Specifications of robots, fixed versus flexible automation.

Applications of robot: Economic analysis, Robot applications in Material Handling, Processing and assembly.

UNIT II **(12)**

Robot End Effectors: Introduction, end effectors, interfacing, types of end effectors, grippers and tools.

Selection: Selection and Design Considerations of End effectors, Remote Centre Compliance device.

UNIT III **(12)**

Robotic Sensory Devices:

Position Sensors: Objective, Non-optical position sensors - potentiometers, synchros, inductocyn, optical position sensors – opto interrupters, optical encoders (absolute & incremental).

Proximity Sensors: Contact type, non-contact type – inductive, capacitive proximity sensors, optical proximity sensor, and scanning laser proximity sensor.

UNIT IV **(12)**

Touch and Slip Sensors: Proximity rod & photo detector tactile sensor, slip sensors - Forced oscillation slip sensor, interrupted type slip sensors.

Transformations: Objectives, homogenous coordinates, basic transformation operations, fixed angle representation, Euler angle representation.

UNIT V **(12)**

Forward Kinematics: Forward solution – Denavit Hartenberg procedure. Simple problems involving 2 and 3 DOF manipulators, SCARA manipulator.

Robot Programming: Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

LEARNING RESOURCES

TEXT BOOKS:

Robotic Engineering by Richard D.Klafter, Prentice-Hall of India Pvt Ltd, 2010.
Industrial Robotics by Mikell P. Groover, Tata McGraw-Hill Int. Edition 2, 2012.
Robotics and Control, R.K. Mittal and I.J. Nagarath, TMH, 2005[4 UNIT- 1st chapter].

REFERENCE BOOKS:

Introduction to Robotics: Mechanics And Control, John J.Craig 3rd Edition, Pearson, 2008.
Robotics: Control, Sensing, Vision, and Intelligence, K. S. Fu, R. C. Gonzales, and C. S. G. Lee, Tata McGraw-Hill, NY, 2008.
Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, Prentice Hall, NJ, 2010.

WEB REFERENCES:

- http://nptel.iitm.ac.in/courses.php?branch=Mechanical
- http://academicearth.org/courses/introduction-to-roboticsVideo references:-

ME 404B Elective- III	OPERATIONS RESEARCH [OPEN ELECTIVE]	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Grasp the methodology of OR problem solving and formulate linear programming problem.
2. Develop formulation skills in transportation models and finding solutions
3. Understand the basics in the field of game theory and assignment problems
4. Be able to know how project management techniques help in planning and scheduling a project
5 Be able to know the basics of dynamic programming and simulation.

COURSE OUTCOMES:

a. Recognize the importance and value of Operations Research and linear programming in solving practical problems in industry
b. Interpret the transportation models' solutions and infer solutions to the real-world problems.
c. Recognize and solve game theory and assignment problems.
d. Gain knowledge of drawing project networks for quantitative analysis of projects
e. Know when simulation and dynamic programming can be applied in real world problems.

UNIT I **(12)**

Linear Programming : Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.

UNIT II **(12)**

Transportation Problem: Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method. Finding optimal solution by MODI method, degeneracy, unbalanced transportation problem and Maximization in transportation model.

UNIT III **(12)**

Assignment Problem: One to one assignment problem, optimal solutions, unbalanced assignment matrix, travelling sales man problem, maximization in A.P.

Theory of Games: Introduction, rectangular two person zero sum games, solution of rectangular games in terms of mixed strategies, solution of 2x2 games without saddle point, concept of dominance to reduce the given matrix, Graphical method for 2xn and nx2 games.

UNIT IV **(12)**

Project Planning through Networks: Introduction, Basic steps in PERT/CPM techniques, Network diagram representation, Rules of drawing network diagram, Fulkerson's rule, Time estimates and Critical path in network analysis, floats, Project evaluation and review technique, Application areas of PERT/CPM techniques.

UNIT V **(12)**

Dynamic Programming: Introduction, Characteristics of D.P. model, the recursive equation approach, Computational Procedure in dynamic Programming, solution of an L.P. by D.P

Simulation: Introduction, Monte-Carlo Simulation, Application to Inventory Control, Application to Queuing Problems

LEARNING RESOURCES

TEXT BOOKS:

1. Operations Research - S.D. Sharma, Kedar nath Ram nath & Co, 2008.
2. Operations Research - Theory and Applications ,J.K Sharma, Macmillan Publications India Ltd, 2013

REFERENCES

1. Operations Research - H.A. Taha , Pearson , 7th Edition, June 2002.
2. Introduction to Operations Research - Hiller and Liberman, MGH, 7th Edition, 2002.

WEB REFERENCES :

- http://www2.informs.org/Resources/
- http://www.mit.edu/~orc/
- http://www.ieor.columbia.edu/
- http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
- http://www.wolfram.com/solutions/OperationsResearch/

EE 405	INDUSTRIAL MANAGEMENT	L	T	P	C
		4	--	--	3

COURSE OBJECTIVES:

1. To provide the students with a foundation of knowledge in management of organizations.
2. To provide a business organization which produces a very good quality products but it must satisfy the needs, wants and desires of the consumer.
3. To alert the students to understand the time value of money for evaluation of several project alternatives.
4. To give knowledge to the students for avoiding any delays in production processes due to non availability of material by effectively managing the function of materials management.
5. To sensitize the students to the changing environment and its implication for managing the human resources to achieve the corporate excellence in a changing environment.
6. To give an idea to the students to get the information about the different set of organizations and to develop themselves as successful entrepreneurs.
7. To give an idea about which form of business organization is suitable for todays business environment and their impact towards society.

COURSE OUTCOMES:

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

1. understand the customer perception, making him to buy the products and retaining the customer in a business.
2. get knowledge about time value of money in the changing society and to get awareness about the calculation of several assets for tax purpose.
3. linkage corporate vision, mission, strategies, and policies to human resource management to acquire competitive advantage and to frame strategies to develop talent and to retaining talent.
4. become aware of the inference of organization structure and performance of people working in organizations and to develop themselves as individual entrepreneurs for the society.
5. get awareness of managing the projects in various organizations by using different techniques.

Course Content:

UNIT – I **[Text Book-1] (12)**

GENERAL MANAGEMENT:

Management Concept, Managerial Roles,Managerial Skills, Brief treatment of managerial functions,Scientific Principles of Management, 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 Books – 1,2] (12)**

FINANCIAL MANAGEMENT:

Objectives of Financial Management, Concept of interest, compound interest, equivalent cash flow diagram

ECONOMIC EVALUATION OF ALTERNATIVES:

Basic methods, the annual equivalent method, present worth method, future worth method.

DEPRECIATION:

Purpose, types of depreciation, common methods of depreciation. The straight line method, declining balance method, the sum of the years digits method.

UNIT – III **[Text Book-1] (12)**

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, Job Evaluation, Career Planning and Development, Stress Management, Compensation

Directing: Motivation and Leadership, Theories of motivation and styles of Leadership.

UNIT – IV **[Text Book- 1] (12)**

MATERIAL MANAGEMENT:

Functiions of Materials Management, Material Requirement Planning, Purchasing, Objectives of Purchasing, Source Selection, Procurement Methods, Vendor Rating ,Inventory Management –EOQ, EPQ, ABC Analysis,FSNAnalysis,VED Analysis.

UNIT – V **[Text Book- 1] (12)**

MARKETING MANAGEMENT: Functions of Marketing, Marketing Mix,Product life cycle, Channels of distribution, Marketing Segmentation,Advertising& Sales promotion, Market Research.

Learning Resources

Text Books:

1. KK Ahuja, Industrial Management, Vol. I & II, Dhanpat Rai, 1978.
2. E.PaulDegarmo, John R Chanda, William G Sullivan, Engineering Economy, Mac Millan Publishing Co, 1979.

Reference Books:

1. Philip Kotler, Marketing Management, 11th Edition, Pearson Education, 2004.
2. P. Gopalakrishnan, Hand Book of Materials Management, PHI, 1999.
3. Gary Dessler,Human Resource Management, Pearson Education11th Edition,2008.
4. Heinz Weirich and Harold Koontz, Management, 10th Edition, TMH, 2004.

Web References:

1. *www.managementstudyguide.com*: Describes the Concepts of Management &Its Operational Functions.
2. *www.1000ventures.com* : Describes about Management Gurus, Business Gurus.
3. *www.citehr.com* : Describes the Human Resource Management Topics.

EE 406A Elective – IV	INDUSTRIAL DRIVES	L	T	P	C
		4	--	--	3

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. Understand various drive mechanisms and closed loop control strategies of drives
2. Apply power electronic converters (AC to DC) to control the speed of DC motors
3. Apply power electronic converters (DC to DC) to control the speed of DC motors
4. Apply power electronic converters to control the speed of induction motors
5. Apply power electronic converters to control the speed of synchronous motors and understand the methods for energy conservation

COURSE CONTENT:

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

Introduction and Dynamics of Electric Drives: Electric drives, advantages of electric drive, parts of electric drives, Choice of electrical drives, Status of dc and ac 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: Starting of DC motors, methods of braking. 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.

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

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.

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

UNIT – IV [Text Book- 1] (12)

Speed control from stator side: Stator voltage control by A.C. voltage controllers, Variable frequency control from voltage sources, VSI control, Variable frequency control from current source, CSI control, Comparison of VSI and CSI drives, Eddy current drives.

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

UNIT - V [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. GK Dubey SR 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 406B Elective – IV	POWER PLANT INSTRUMENTATION	L 4	T --	P --	C 3

Course Objectives:
1. To give an overview of different equipment used in power generation systems
2. To furnish knowledge on Instrumentation and control of different circuits in steam power plant
3. To provide information on Supervisory control system of power plant operation

Course Outcomes:
Upon completion of the course the student attains familiarity with
1. Different equipment used in Power plants along with their control schematics
2. Control loops of different circuit schemes
3. Instrumentation in air fuel circuitry
4. Computer based power plant control
5. Turbine monitoring and control

UNIT – I **[Text Book – 1] (12)**

Importance of Instrumentation and control in Power generation: Classification of Instruments in power plant – Objectives of Instrumentation and control
Piping and instrumentation diagram - Cogeneration of power - Control rooms.

UNIT – II **[Text Book – 1] (12)**

Instrumentation in water circuit: Water circuit - Boiler feed water circulation – Measurements in water circuit
Control in water circuit: Controls in water circuit – Impurities in water and steam

UNIT – III **[Text Book – 1] (12)**

Instrumentation in Air-Fuel circuit: Air-Fuel circuit – Measurements in Air fuel circuit
Control in Air-Fuel circuit: Controls in Air fuel circuit – Analytical measurements

UNIT – IV **[Text Book – 1] (12)**

Power Plant Management: Master control – Combustion process – Boiler efficiency – Maintenance of measuring instruments – Intrinsic and electrical safety
Interlocks for boiler operation - Computer based control and data logging systems – Distributed control system

UNIT- V **[Text Book – 1] (12)**

Turbine monitoring: Introduction – Turbine steam inlet system – Turbine Measurements
Turbine control: Turbine Control system – Lubrication and Cooling system and their controls

Learning Resources:

Text Books:
1. K. Krishnaswamy , M. PonniBala,Power plant instrumentation - First edition, PHI, 2011
2.MML Wakil, Power Plant technology –TMH Publishing company Ltd., New Delhi

Reference Books:

1. M.V. Deshpande,Elements of Electrical power station design –Wheeler Publishing Co.
2. David Lindsey,Power-plant control and instrumentation : The control of boilers and HSRG systems, IEE control engineering series, 58, 2000.

Web Resources:

1. www.siemens.co.in % For information on Instrumentation of power plant
2. http://www.niceindia.com/qbank/POWER_PLANT_INSTRUMENTATION_EI1002_.pdf % for model questions
3. http://www-pub.iaea.org/MTCD/publications/PDF/TRS387_scr.pdf % Guide book for control and instrumentation of nuclear power plant
4. www.abb.com % Overview of Electrical Instrumentation and control equipment in power plants

EE 406C Elective – IV	EHV AC TRANSMISSION	L	T	P	C
		4	--	--	3

Course Objectives:

1. To enable the students with fair knowledge on the transmission line parameter evaluation methods and compensation methods of getting better performance of the lines.
2. To facilitate the students about the corona and affects of corona and the design of the lines based on stability limits.

Course Outcomes:

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

1. Understand the positive, negative and zero sequence impedance of a given network and various parameters of a transmission line.
2. Gain the knowledge of electrostatic field and voltage gradients of AC lines
3. Understand the methods of power frequency voltage control methods and compensation methods with static Vars.
4. Know corona loss formulae , audio noise due to corona and methods of measuring of RI and RIV.
5. Get the idea of design of EHV lines based on steady state and transient limits and characteristics of EHV cables.

COURSE CONTENT:

UNIT- I: **[Text Books 1 &2] (12)**

E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters

Bundle conductor systems-Inductance and Capacitance of E.H.V. lines – positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT- II: **[Text Books 1 &2] (12)**

Electrostatic field and voltage gradients – calculations of electrostatic field of AC lines – effect ofhigh electrostatic field on biological organisms and human beings

surface voltage gradients and maximum gradients of actual transmission lines – voltage gradients on sub conductor.

UNIT- III: **[Text Books 1 &2] (12)**

Electrostatic induction in un-energized lines – measurement of field and voltage gradients for threephase single and double circuit lines – un energized lines.

Power Frequency Voltage control and over-voltages in EHV lines: No load voltage – charging currents at power frequency-voltage control – shunt and series compensation – static VAR compensation.

UNIT - IV: **[Text Books 1 &2] (12)**

Corona in E.H.V. lines – Corona loss formulae- attention of traveling waves due to Corona –Audio noise due to Corona, its generation, characteristic and limits.

Measurements of audio noise radio interference due to Corona - properties of radio noise – frequency spectrum of RI fields –Measurements of RI and RIV.

UNIT- V: **[Text Books 1 &2] (12)**

Design of EHV lines based on steady state and transient limits

EHV cables and their characteristics.

Learning Resources:

Text Books:

1. S. Rao- "HVAC and DC Transmission",Kanna publications,3 rd edition,1999.
2. R. D. Begamudre-"EHVAC Transmission Engineering" New Age International (p) Ltd,4 th edition,2011.

Reference Books :

1. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering"– New Age International, Revised edition,2007
2. Edison, "EHV Transmission line"- Electric Institution, (GEC 1968).
3. E. Uhlmann-"Power Transmission by Direct Current" B. S. Publications,1st edition,1975.

Web Resources:

1. http://www.transform.ru/articles/pdf/sigre/b1-304.pdf
2. http://www.generalcable-fr.com/Portals/france/pdf/en/2101_HVleaflet.pdf
3. https://3ee2108sdg.wordpress.com/2015/10/01/design-of-345-kv-ehv-ac-transmission-line/
4. https://3ee2108sdg.wordpress.com/lab-index-of-ehv-ac-and-dc-transmission/

EE 406D Elective – IV	ENERGY CONSERVATION & AUDIT	L 4	T --	P --	C 3

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. Gain the knowledge on various methods of energy auditing of industries, buildings along with the conservation schemes.
2. Understand the energy management schemes and controlling methods.
3. Understand variable speed , variable duty cycle systems and unbalanced voltage systems with compensating methods.
4. Gain the knowledge on power factor improvement methods and operation of energy instruments.
5. Understand the economics analysis and aspects of the apparatus with different techniques.

COURSE CONTENT:

UNIT-I: [Text Book1] (12)

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] (12)

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] (12)

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

UNIT-IV: [Text Book1] (12)

POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS

Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on power factor, power factor motor controllers

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.

UNIT-V: [Text Book1] (12)

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.

EE 451	MINI PROJECT / TERM PAPER	L	T	P	C
		--	--	3	2

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

1. Get practical exposure in the field of Electrical & Electronics Engineering
2. Identify the topic for project work in prior in term paper along with his group
3. Understand the problem and its analysis
4. Know the latest computational tools available
5. Get the solution for the engineering problems

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 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 452	POWER ELECTRONICS LAB	L	T	P	C
		--	--	3	2

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 ableto:

1. Acquire knowledge on various power electronic devices
2. Knowledge on various power electronic converters, design and applications.
3. Able to 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 modified series inverter with R & RL loads
7. Characteristics of single - phase parallel inverter with R & RL loads
8. Characteristics of single - phase Cyclo-converter (Center tapped or Bridge)
9. Characteristics of single - phase full wave McMurray Bedford inverter
10. Characteristics of Single phase dual converter
11. Characteristics of Three phase fully controlled rectifier with R, RL and RLE loads
12. Speed control of Universal motor
13. Characteristics of Morgan's chopper
14. Characteristics of PWM Inverter based three phase Induction motor.
15. Speed control of induction motor using three phase AC voltage controller
16. 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 453	POWER SYSTEMS LAB	L	T	P	C
		--	--	3	2

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.
4. Determine parameters of transmission line, loading capability, compensation equipment required in practical transmission network.
5. Analyze the performance of insulators and cables by High voltage testing.

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

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

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 407	UTILIZATION OF ELECTRIC POWER	L	T	P	C
		4	--	--	3

Course Objectives:

1. To make students learn the various usage of electrical energy such as illumination, heating, welding etc.
2. To impart the knowledge on electric traction as it is one of the most important applications of Electrical Engineering.
3. To provide specific knowledge of batteries
4. To derive the heating and cooling curve and to study the various classes of duty and Selection of power rating.

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. Understand various types of traction systems & mechanics of train movement
3. Calculate SEC for a given train service and control methods of traction motors
4. Understand various types of Heating, Welding systems
5. 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)

ELECTRICTRACTION-I

Electric traction systems:

Systems of electric traction, systems of track electrification, comparison between DC and AC systems.

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.

UNIT – III [Text Book-1] (12)

ELECTRICTRACTION-II

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 – IV [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 - V [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.

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/L-20(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)

EE 408	POWER SYSTEM OPERATION & CONTROL	L	T	P	C
		4	--	--	3

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. Know the importance of economic operation of power systems.
2. Know the importance of single area and two area AGC.
3. Know the importance of voltage control of distribution systems.
4. Control the voltage and reactive power in practical case also.
5. Solve the Power management problems in industries and utilities with the help of computers applications in power system.

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.

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

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.
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.

UNIT–V [Text Book – 3] (12)

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

Distribution Automation: Flow diagram for man machine power system interface. Schematic diagram of Remote Terminal Unit. Block diagram of smart and intelligent transmitter, SCADA system.

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

EE 409A ELECTIVE – V	HVDC TRANSMISSION	L 4	T --	P --	C 3

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. Understand the importance of HVDC Links and converters
2. Analyze converter configurations used in HVDC transmission and list the performance metrics
3. Get an idea about converter faults and protection schemes
4. Get an idea about control of converters and HVDC system
5. Understand existence of harmonics in HVDC system and design of filter circuits

COURSE CONTENT:

Unit –I: [Text Book-1] (12)

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] (12)

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] (12)

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 deenergization of a bridge - power control – reactive power control-sub synchronous Damping control.

Unit-IV: [Text Book1& 2] (12)

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.

Unit-V: **[Text Book 1] (12)**
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. E.Uhlmann, 'Power Transmission by Direct Current', Springer-Verlag,1975.
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

EE 409B ELECTIVE – V	ELECTRICAL DISTRIBUTION SYSTEMS	L	T	P	C
		4	--	--	3

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 planning, automation, design of sub transmission lines and distribution substation.
3. To develop skills for applying them in future on various engineering applications.
4. To teach the analysis and design of primary and secondary systems.
5. To give an idea on calculation of voltage drops, power losses and capacitive compensation required in distribution systems.

Course Outcomes:

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

1. Understand the concepts of distribution system Planning.
2. Assess the design of new distribution system Planning.
3. Design simple distribution system, sub transmission lines, primary feeder and Secondary feeders.
4. Connect the course content to real time applications in various electrical and electronics engineering applications.
5. Get solutions for problems related to voltage drop and power loss calculations and understand applications of capacitors in distribution systems.

COURSE CONTENT:.

UNIT - I [Text Book – 1&2] (12)

Distribution systems planning: 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&3] (12)

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&3] (12)

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.

UNIT-IV [Text Book – 1&3] (12)

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.

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.

UNIT-V [Text Book – 1&3] (12)

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 TuranGonen, Electric Power Distribution System Engineering, MGH.
2. Dr. V. Kamaraju,Electrical Distribution Systems, Right Publishers.
3. Sivanagaraju&Sankar,Electrical Power Distribution Automation,Dhanpatrai& Sons.

Reference Books:

1. A.S. Pabla, Electric Power Distribution,TMH, 4thEd., 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 electricdistribution .html

EE 409C	EMBEDDED SYSTEMS & VLSI	L	T	P	C
ELECTIVE – V		4	--	--	3

Course Objectives:

1. To enable the students with fair knowledge on the processor technology and design of MOS & BIMOS technology
2. To facilitate the students about the layout of Subsystem, system synthesis and Hardware/Software code design.

Course Outcomes:

Upon successful completion of the course, the student will be ableto:

1. Understand the processor technology and RT Level combinational logic - sequential logic.
2. Gain the knowledge on basic architecture and pipelining of general purpose processors.
3. Understand the operation and design of MOS & BIMOS technology and scaling of MOS circuits.
4. Gain the knowledge on design and layout of Subsystem, Illustration of Design Process
5. Understand the parallel evolution of compilation and synthesis, system synthesis and Hardware/Software code design.

COURSE CONTENT:

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

Introduction: Embedded systems overview - design challenge - processor technology – IC technology - Design technology - Tradeoffs.

Single purpose Processors: RT Level combinational logic - sequential logic (RT-LEVEL) - optimizing custom single purpose processors.

UNIT – II **[Text Book 1] (12)**

General purpose processors: Basic architecture - operation – pipelining - programmer's view - development environment

Application specific instrumentation – set processors (ASITPS) – Micro controllers and Digital signal processors.

UNIT-III **[Text Book 2] (12)**

MOS & BIMOS Technology: An introduction to MOS technology - BIMOS technology - Basic electrical properties of MOS & BIMOS circuits - MOS and BIMOS circuit design processors.

Basic circuit concepts - sheet resistance - area capacitances of layers - the delay unit - scaling of MOS circuits - scaling models - scaling factors for device parameters.

UNIT-IV **[Text Book 2] (12)**

Subsystem design and layout: Architectural issues, Switch logic, Gate Logic, examples of Structured Design (combinational logic):Parity Generator, Bus Arbitration Logic.

Illustration of Design Process: Design of an ALU subsystem, Manchester carry chain, carry select adder, carry skip adder.

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

Design Technology: Introduction to automation – synthesis - the parallel evolution of compilation and synthesis - logic synthesis - RT synthesis - behavioral synthesis.

system synthesis and Hardware/Software code design – verification - Hardware/Software co simulation - reuse of intellectual property coder.

Learning Resources :

Text Books:

1. Frank Vahid, Tony D.Givargis,"Embedded system Design – A unified Hardware/ Software introduction", Wiley India Edition,3 rd edition,2009.
2. Douglas A.Pucknell and Kamran Eshranghian," Basic VLSI Design", PHI ,Third edition, 2002.

REFERENCE BOOKS:

1. Jorgen Staunstrup, Wayne Wolf,"Hardware/Software Co-Design: Principles and Practice", Springer Science & Business Media, 2013.
2. Wayne Wolf,"Modern VLSI Design: IP-Based Design",Pearson Education, 2008.
3. Raj kamal," Introduction to Embedded systems", TMH, 2002

Web References :

1. http://www.nptel.ac.in/courses/108105057/Pdf/Lesson-1.pdf
2. https://www.cse.iitb.ac.in/~cs330/emb-lect.pdf
3. http://profile.iiita.ac.in/bibhas.ghoshal/lecture_slides_embedded/ES_basics.pdf

EE 409D	SMART GRIDS	L	T	P	C
ELECTIVE – V		4	--	--	3

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. Understand the structure of an electricity market in either regulated or deregulated market conditions.
2. Understand how (wholesale) electricity is priced in a transmission network.
3. Evaluate the trade-off between economics and reliability of an electric power system.
4. Understand the impacts of renewable resources to the grid and the various issues associated with integrating such resources to the grid.
5. Understand the concepts and principles of Smart Grid, technology enabling, and demand participation.

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.

UNIT–II **[Text Book 1] 12**

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.

INTELLIGRID ARCHITECTURE FOR THE SMARTGRID: Introduction- Launching intelligrid-Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies.

UNIT–III **[Text Book 1] 12**

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–IV **[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–V: [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/Day-2%20IITK/Smart%20Grid%20Concept%20&%20Deployment-%20Dr.%20Saikat%20Chakrabarty.pdf

EE 410A ELECTIVE – VI	FACTS CONTROLLERS	L 4	T --	P --	C 3

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. Understand the importance of FACTS controllers in transmission system to enhance the system performance, control strategies for different types of converters for static compensation.
2. To understand the objectives of shunt and series compensators and their types, comparison of transient and dynamic stability performance of different controllers.
3. Importance of static voltage and phase angle regulators towards active, reactive power flow control and improvement of transient stability.
4. To understand the concept of UPFC and IPFC, control strategies for controlling P and Q.
5. To know the design and operational aspects of special purpose FACTS devices like TCBR, NGH-SSR damping scheme.

COURSE CONTENT:

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

FACTS Concept and General system Considerations:

Transmission Interconnections-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-Brief Description and definitions 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] (12)

Static Shunt Compensators: SVC and STATCOM

Objectives of Shunt Compensation-Methods of variable Var Generation-Static Var Compensators: SVC and STATCOM-Comparison between SVC and STATCOM for transient and dynamic enhancement.

Static Series Compensation: GCSC, TSSC, TCSC and SSSC

Objectives of series Compensation-Variable Impedance type series Compensators-Switching Converter Type series Compensators-External (System) Control for series Reactive Compensators

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

Static Voltage and Phase Angle Regulators: TCVR and TCPAR

Objectives of Voltage and Phase Angle Regulators: Voltage and Phase angle regulation-power flow control by phase angle regulators-real and reactive loop power flow control-Improvement of transient stability with phase angle regulators-Functional requirements.

Approaches to thyristor-Controlled voltage and phase angle regulators (TCVRs and TCPARs):
Continuously Controllable thyristor tap changers-Thyristor tap changer with discrete level control-thyristor tap changer valve rating considerations-switching converter based voltage and phase angle regulators-Hybrid phase angle regulators.

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

Unified Power Flow Controller (UPFC):
Basic operating principles-conventional transmission control capabilities-Independent real and reactive power flow control-Comparison of UPFC to series compensators and phase angle regulators-Control structure-Basic control system for P and Q control-Dynamic performance-Hybrid arrangements.

Interline Power Flow Controller (IPFC):
Basic operating principles and characteristics-control structure-practical and application considerations.

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

Coordination of FACTS Controllers:
Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.

Special Purpose Facts Controllers: NGH-SSR Damping scheme and TCBR
Sub synchronous Resonance-NGH-SSR Damping Scheme: Basic concept –Design and operation aspects.
Thyristor-controlled Braking Resistor (TCBR): Basic concept- Design and operation aspects. (10)

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

EE 410B Elective – VI	DIGITAL CONTROL SYSTEMS	L 4	T --	P --	C 3

Course Objectives:

1. To provide sufficient theoretical and analytical background to understand the concepts of continuous time discrete systems.
2. To understand the basics of Z- Transform, stability analysis of digital control system feedback controller design.

Course Outcomes:

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

1. Understand the concept of sample and hold operation and apply Z-transforms to Digital systems.
2. Apply the concept of state space to test the performance of digital control systems.
3. Test the stability of digital control systems.
4. Design compensators and controllers to achieve the desired performance by conventional methods.
5. Design controller by pole-placement technique to achieve desired system-behavior.

COURSE CONTENT:

UNIT – I [Text Book- 1] (12)

Sampling and Z-plane Analysis : Introduction, sample and hold operations, Sampling theorem, Reconstruction of original sampled signal to continuous-time signal.

Review of z-transforms :Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled- data systems, mapping between s-plane and z-plane: Primary strips and Complementary Strips.

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

State Space Analysis: State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state - space equations.

Controllability and Observability: Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

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

Stability Analysis: Stability Analysis of closed loop systems in the ZPlane. Jury stability test - Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

Stability analysis using Liapunov theorems.

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

Design Of Discrete Time Control System By Conventional Methods:

Design of digital control based on the frequency response method -Bilinear Transformation and Design procedure in the w-plane.

Lead, Lagand Lead-Lag compensators and digital PID controllers. Design digital control through deadbeat response method.

UNIT - V [Ref. Book- 2] (12)

State Feedback Controllers And Observers: Design of state feedback controller through pole placement - Necessary and sufficient conditions, Ackerman's formula.

Linear Quadratic Regulators: Min/Max principle, Linear Quadratic Regulators

Learning Resources:

Text Books:

1. Kuo,'Digital Control Systems', Oxford University Press, 2nd Edition, 2003.
2. K. Ogata,'Discrete-Time Control systems', Pearson Education, 2nd Edition, 1994.

Reference Books:

1. M. Gopal,'Digital Control Engineering', Wiley Eastern, 3rd Edition, 2008.
2. K.Ogata, 'Moderncontrolengineering',PHI, 5th Edition, 2010.
3. M.Gopa,'Digital Control and State Variable Methods', TMH,3rd Edition, 2008.

Web Resources:

1. www.dcs-inc.net
2. www.dcsmicros.com
3. www.idsc.ethz.ch/Courses/digital_control
4. www.dynacord.com
5. www.dicsglobal.com

EE 410C Elective – VI	COMPUTER NETWORKS	L 4	T --	P --	C 3

Course Objectives:

1. To describe the uses of networks, network interfaces and different types of networks.
2. To analyze and evaluate the network reference model suitable for any organization.
3. To identify protocol stack and design Issues for the Layers.
4. To identify requirements needed to design a computer network
5. To interpret optimal routing algorithms for routing the packets on the network.
6. To define Quality of service measures for any network.
7. To demonstrate different congestion detection and control mechanisms.

Course Outcomes:

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

1. analyze and determine the requirements and appropriate protocols for developing a network and design a network architecture considering interfaces, services and protocols.
2. apply contemporary issues in networking technologies for various applications, narrate the congestion control algorithms required for eliminating data losses in the network.
3. implement various routing algorithms like distance vector routing, flooding and Shortest Path.
4. differentiate connection oriented and connection less services of networks.
5. demonstrate multimedia applications like VOIP, Video Compression, Video on Demand etc.

Course Content:

UNIT – I **[Text Book – 1] (12)**

Introduction: Uses of Computer networks, Network Hardware, Network Software, Reference Models (OSI and TCP/IP only).

Physical Layer: Introduction to Guided Transmission Media, Wireless Transmission

UNIT – II **[Text Book – 1] (12)**

Data Link Layer: Data Link Layer design issues, Error detection and correction, Elementary Data link Protocols, Sliding window protocols.

Medium Access Control Sub layer: The channel Allocation problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband wireless, Bluetooth, Data Link Layer Switching.

UNT – III **[Text Book – 1] (12)**

Network Layer: Network layer Design Issues,

Routing Algorithms – (The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts.)

UNIT – IV **[Text Book – 1] (12)**

Congestion Control Algorithms, Quality of Service - (Requirements, Techniques for Achieving Good Quality of Service),

Internetworking, The Network layer in the internet- (The IP Protocol, IP Address, Internet Control Protocols, OSPF, BGP).

UNIT – V **[Text Book – 1] (12)**

Transport Layer: Elements of Transport Protocols, TCP, UDP,RTP.

Application Layer: DNS, Electronic Mail, The World Wide Web (Architectural Overview only) Multimedia.

Learning Resources:

Text Books:

1. A.S Tanenbaum, Computer Networks, 4th Edition, PHI, 2003
2. Behrouz A. Foruzan, Data communication and Networking, 4thEdition,TMH, 2004.

Web References

1. Wireshark Packet Analyzer (http://www.wireshark.org/)
2. Computer Networks on Wikipedia (http://en.wikipedia.org/wiki/Computer_network)
3. RFCs - Request For Comments (http://www.rfc-editor.org/rfc-index2.html)
4. Novell Networking Primer (http://www.novell.com/info/primer/primer.html)
5. Internet Videos

a. History of the Internet (www.youtube.com/watch?v=9hIQjrMHTv4*)*
b. BGP at 18: Lessons in Protocol Design (www.youtube.com/watch?v=HAOVNYSnL7k)

EE 410D Elective – VI	INDUSTRY OPEN SLOT	L	T	P	C
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Course Objectives:

1. To bridge the gap between academia and industry
2. To provide hands-on experience on new technologies
3. To prepare the students for current industry requirements

Course Outcomes:

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

1. Understand the current needs of the industry
2. Engage in lifelong learning
3. Use techniques, skills, and modern engineering tools
4. Analyse and solve the problems of the society

Note: The syllabus will be decided as suggested Industry and proposals of Board of Studies.

EE 454	SIMULATION OF ELECTRICAL SYSTEMS LAB	L	T	P	C
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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 Y_{bus} by inspection
16. Develop a program for Z_{bus} using Z_{bus} 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.

Note: A minimum of 10 experiments are to be completed.

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 455	PROJECT WORK	L	T	P	C
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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

Learning Outcomes:

The student will have an exposure to

1. Research and development procedures
2. Latest developments in the selected areas, software development
3. Development of a prototype solution to industrial/ theoretical problems
4. Publish paper in National or International conferences
5. Function effectively on teams to accomplish a common goal

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.