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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**Cluster C**

# HIGH LIGHTS OF THE SYLLABI

**Proposed Edition 2014**

This document provides the curriculum for the following programmes:

* B. Tech Electrical Engineering
* B. Tech Electrical Engineering + M. Tech Power Systems DD
* M. Tech Power Systems

From Edition 2013, the following changes have been made in Edition 2014:

* **B.Tech. Electrical Engineering**

|  |  |  |
| --- | --- | --- |
|  | **Course Code and Name  (Edition 2013)** | **Course Code and Name  (Edition 2014)** |
| 1. | CP 423 - Database Management System | EE410 - Electrical Engineering Material |
| 2. | CP457 - DBMS Lab | EE457 - Electrical circuit Lab |
| 3. |  | EE608 – Restructured Power system (M.Tech III) |
| 4. | EE201 - Electronics measurement and instrumentation | EE201 - Measurements and Instrumentation |
| 5. | EE203 - Network theory I | EE203- Circuit Theory I |
| 6. | EE205 - Electromechanical energy conversion I | EE205 - Electro-mechanics I |
| 7. | EC221 - Basic electronics | EC221 - Analog Electronics Circuits |
| 8. | EE251 - Electronics measurement and instrumentation lab | EE251 - Measurements and Instrumentation Laboratory |
| 9. | EE253 - Electromechanical energy conversion I lab | EE253 - Electro-mechanics I Laboratory |
| 10. | EC253 - Electronics Devices and Circuits lab | EC253 - Electronics Laboratory – I |
| 11. | EE202 - Network theory II | EE202 - Circuit Theory II |
| 12. | EE204 - Electromechanical energy conversion II | EE204 - Electro- mechanics II |
| 13. | EC212 - Advanced electronics | EC212 - Analog Integrated Circuits |
| 14. | EC204 - Digital electronics | EC204 - Digital Electronics Circuits |

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**Cluster C**

# HIGH LIGHTS OF THE SYLLABI

**Curriculum for academic session 2014-2015 for the programs given below**

**- B. Tech Electrical Engineering**

**- B. Tech EE + M.Tech Power Systems DD**

**- M.Tech Power Systems**

**A. COURSE NUMBER CODING SCHEME**

# Coding for all the papers has been done so as to make syllabi more systematic and easy to locate.

1. A course is identified by a **course code** designated by a string of five alphanumeric characters and a course title.

2. In a course code, first two letters of the string indicate the **Department/School** offering the course and the later three numerals designate a particular **course number**. The letters symbolizing various Academic Department offering a course are:

DC Discipline and Co-curricular Activities

CY Chemistry

EN English

HS Humanities and Social Sciences

MA Mathematics

PY Physics

CA Computer Application

CE Civil Engineering

CP Computer Engineering

EC Electronics & Communication Engineering

EE Electrical Engineering

IT Information Technology

ME Mechanical Engineering

BM Business Management

HM Hotel Management

PH Pharmacy

SC Sciences

**3. Course number**

a. First Numerical digit denotes the level of the course that corresponds to the Year of Study.   
b. Next two Numerical digits denote the number of the course, which will usually be odd for courses offered in the Odd Semester and even for courses offered in the Even Semester.  
c. Lower levels corresponds the UG courses, while higher level the PG courses. Suggested levels will be as follows

|  |  |  |
| --- | --- | --- |
| **All UG Programmes** | **All PG programmes** | **PG Diploma** |
| Level 1 to 4 | Level 5 to 7 | Level 8, 9 |

**EXAMPLES:**

|  |  |
| --- | --- |
| **UG Programmes** | **PG programmes** |
| For e.g. EE 203  EE denotes Electrical Engineering  2 denoted second Year  03 represent Course | For e.g. EE 503  EE denotes Electrical Engineering  5 denoted First Year of PG Programme  03 represent Course |

# B. CREDIT SYSTEM

# Each academic year consists of two semesters and a summer term. The education system is organized around a credit system, which ensures continuous evaluation of the student's performance and provides at an optimum pace suited to one's ability or of credits depending upon the class contact hours. A minimum number of credits are to be completed in order to qualify for the award of degree. A minimum level of performance is necessary for satisfactory progress. SGVU has revised its curriculum with effect from the academic session 2009-2010. The revised curriculum emphasizes on self-learning, project activity and laboratory work. It leaves sufficient time for the student to take part in other activities like sport and recreation as well as to think and to be creative and innovative.

# The prominent features of the credit system are : the process of continuous evaluation of a student's performance, the absence of pass or fail on annual basis and the flexibility to allow a student to progress at a pace suited to his/her individual ability and convenience subject to the regulation of the credit requirements.

# Each course, except for a few special courses, has a certain number of credits assigned to it depending on its lecture, tutorial and laboratory work contact hours in a week. Each course is coordinated by a member of the faculty called the course coordinator. He/she has the full responsibility for coordinating the course, faculty involved in the course, holding tests and awarding grades. In case of any difficulty, students are expected to approach the course coordinator for advice and clarification.

A letter grade with a specified number of grade points is awarded in each course for which a student is registered. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average maintained by him/her. A minimum number of credits and a minimum grade point average are necessary in order to qualify for the degree.

# B.TECH

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Semester** | **Theory Courses** | | | **Practical Courses** | | | | **DECA** | **Total Credits** |
| **Core** | **Deptt. Elective** | **Open Elective** | **Lab** | **Seminar** | **Project** | **Dissertation** |
| **I** | 20 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 26 |
| **II** | 20 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 27 |
| **III** | 19 | 3 | 0 | 4 | 0 | 0 | 0 | 2 | 28 |
| **IV** | 19 | 3 | 0 | 4 | 0 | 0 | 0 | 2 | 28 |
| **V** | 19 | 0 | 3 | 4 | 0 | 0 | 0 | 2 | 28 |
| **VI** | 18 | 0 | 3 | 3 | 0 | 2 | 0 | 2 | 28 |
| **VII** | 17 | 4 | 0 | 2 | 1 | 2 | 0 | 2 | 28 |
| **VIII** | 14 | 0 | 0 | 3 | 4 | 0 | 0 | 2 | 23 |
| **Total Credits** | 146 | 10 | 6 | 29 | 5 | 4 | 0 | 16 | 216 |

**B.TECH + DUAL DEGREE(Power system)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Semester** | **Theory Courses** | | | **Practical Courses** | | | | **DECA** | **Total Credits** |
| **Core** | **Deptt. Elective** | **Open Elective** | **Lab** | **Seminar** | **Project** | **Dissertation** |
| **I** | 20 | 0 | 0 | 4 | 0 | 0 | 0 | 2 | 26 |
| **II** | 20 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 27 |
| **III** | 19 | 3 | 0 | 4 | 0 | 0 | 0 | 2 | 28 |
| **IV** | 19 | 3 | 0 | 4 | 0 | 0 | 0 | 2 | 28 |
| **V** | 19 | 0 | 3 | 4 | 0 | 0 | 0 | 2 | 28 |
| **VI** | 18 | 0 | 3 | 3 | 0 | 2 | 0 | 2 | 28 |
| **VII** | 20 | 4 | 0 | 2 | 1 | 2 | 0 | 2 | 31 |
| **VIIIA** | 17 | 0 | 0 | 3 | 4 | 0 | 0 | 2 | 26 |
| **IX Summer** | 6 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 10 |
| **IX Regular** | 9 | 6 | 0 | 2 | 5 | 0 | 0 | 2 | 24 |
| **X** | 3 | 3 | 0 | 0 | 0 | 0 | 16 | 2 | 24 |
| **Total Credits** | 170 | 19 | 6 | 35 | 10 | 4 | 16 | 22 | 282 |

CGPA stands for Cumulative Grade Point Average.

If you have 8 semesters, your total CGPA will be sum of SGPA’s of all semesters divided by 8.

For students under the 4-point credit system, the procedure is CGPA\*18+20=Equivalent percentage

Eg: If CGPA is 3.00, then the equivalent percentage = 3.00\*18+30=74%

# C. COURSE OUTLOOK:

# The course of B.Tech.in Electrical Engg. is of 4 years. These 4 years are divided in 8 semesters, each of 6 months. After every semester an examination is conducted so that the teachers as well as students get to know their strengths and weakness and work on their weak points to have an overall development.

# ELIGIBILITY

# Eligibility for Admission 10+2 with 70 % and AIEEE/RPET score Credit system based syllabi

# OBJECTIVES OF THE SYLLABI

# •To advance, evolve and enhance Electrical Engg fundamentals

# •To build the interest in students for greater research

# •To guide students in the development of newer languages

# •To create the ability in students for better hardware production

# SIGNIFICANCE AND CARRER OPTIONS OF B.TECH ELECTRICAL ENGG

# Electrical Engg is one of the fastest growing branches of studies which are being carried out all over India. It is one of the most developing and in demand trades of engineering. B.Tech in Electrical Engg.includes study of various aspects of Electrical Engg. to meet the requirements of the various industries. The course contains study of the basic Electrical and its application, as well as the detailed study of the various aspects of its working.

# Today Computers have not only assumed strategic importance in the corporate world, they are also being effectively used in almost every field of human endeavor, ranging from space exploration to food processing and banking to communication etc.

# B.Tech (Electrical Engg.), a study of the theoretical foundations of information and computation, offers a foundation which permits the students to adapt new technologies and ideas. This branch of engineering has many sub-fields for e.g. Transmission and distribution ,Network theory, Power system ,Machines ,Control Theory and much more. After doing B.Tech (Electrical Engg.) from the SGVU, an individual can find a good job in the renowned Electrical Engg. company. He can work in various areas such as:-

# Career Options in B.Tech (Electrical Engg.)

# Electronic Scientist

DRDO

ISRO

BEL

BSNL

HAL

GAIL

SAIL

BHEL

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme common for B.Tech (Electrical Engineering 4 Year Course)**

**Edition 2014  
Year: II Semester: III**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | |  | **A. Theory** |  |  |  |  |  |  |  |
| 1 | | EE 201 | Measurements and Instrumentation | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 2 | | EE 203 | Circuit Theory | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 3 | | EE 205 | Electro-mechanics | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 4 | | EC 221 | Analogy Electronics Circuits | 3 | 3 | 0 | - | 3 | 30 | 70 |
| 5 | |  | **Elective – 1 (any one of the following)** | 3 | 3 | 0 | - | 3 | 30 | 70 |
|  | | EE 207 | Non-Conventional Energy Systems | - | - | - | - | - | - | - |
|  | | MA 201 | Integral Transforms & Complex Analysis | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 6 | |  | **Institutional Core** | - | - | - | - | - | - | - |
|  | | HS203 | Economics | 3 | 3 | - | - | - |  |  |
|  | |  | **B. Practicals / Sessionals** |  |  |  |  |  |  |  |
| 7 | | EE 251 | Measurements and Instrumentation Laboratory | 1 | - | - | 2 | 3 | 60 | 40 |
| 8 | | EE 253 | Electro-mechanics Laboratory | 1 | - | - | 2 | 3 | 60 | 40 |
| 9 | | EC 253 | Electronics Laboratory – I | 1 | - | - | 2 | 3 | 60 | 40 |
| 10 | | EE 255 | Electrical Engineering Drawing | 1 | - | - | 2 | 3 | 60 | 40 |
|  | |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 11 | | DC 201 | Discipline and Co-Curricular Activities – III | 2 |  |  |  |  | 100 |  |
|  | |  | **Total** | **28** | **18** | **4** | **8** |  |  |  |
|  | |  | **Total Teaching Load** |  | **30** |  |  |  |  |  |
|  |  |

**Year: II Semester: IV**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory** |  |  |  |  |  |  |  |
| 1 | MA 202 | Numerical Analysis and Statistics | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 2 | EE 202 | Circuit Theory II | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 3 | EE 204 | Electro- mechanics II | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 4 | EC 212 | Advanced Electronics | 3 | 3 | 0 | - | 3 | 30 | 70 |
| 5 | EC 204 | Digital Electronics Circuits | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 6 |  | **Deptt. Elective - 2 (any one of the following)** | 3 | 3 | 0 | - | 3 | 30 | 70 |
|  | EE 206 | Generation of Electric Power | - | - | - | - | - | - | - |
|  | EE 208 | Advanced Electrical Machine | - | - | - | - | - | - | - |
|  |  | **B. Practicals / Sessionals** |  |  |  |  |  |  |  |
| 7 | EE 252 | Electro- mechanics II Laboratory | 1 | - | - | 2 | 3 | 60 | 40 |
| 8 | EC 252 | Advanced Electronics Laboratory | 1 | - | - | 2 | 3 | 60 | 40 |
| 9 | EC 254 | Digital Electronics Circuits Laboratory | 1 | - | - | 2 | 3 | 60 | 40 |
| 10 | CP 262 | Computer Programming Lab | 1 | - | - | 2 | 3 | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 11 | DC 202 | Discipline and Co-Curricular Activities – IV | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **28** | **18** | **4** | **8** |  |  |  |
|  |  | **Total Teaching Load** |  | **30** |  |  |  |  |  |

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme common for B.Tech (Electrical Engineering 4 Year Course)**

**Edition 2014**

**Year: III Semester: V**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | |  | **A. Theory** |  |  |  |  |  |  |  |
| 1 | | EE 301 | Power Electronics | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 2 | | EC 315 | Micro Processor and Computer Architecture | 3 | 3 | 0 | - | 3 | 30 | 70 |
| 3 | | EE 303 | Control Theory | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 4 | | EE 305 | Transmission and Distribution of Electrical Power. | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 5 | | EE 311 | Power System Instrumentation | 4 | 3 | 1 | - | 3 | 30 | 70 |
| 6 | |  | **Open Elective – 1 (any one of the following)** | 3 | 3 | 0 | - | 3 | 30 | 70 |
|  | | EC 317 | Principle of Communication Systems |  | - | - | - | - | - | - |
|  | | EC 325 | Embedded Systems | - | - | - | - | - | - | - |
|  | | MA305 | Operation Research | - | - | - | - | - | - | - |
|  | | HS 301 | Verbal Non-Verbal Reasoning | - | - | - | - | - | - |  |
|  | |  | **B. Practicals / Sessionals** |  |  |  |  |  |  |  |
| 7 | | EE 351 | Power Electronics Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 8 | | EC 355 | Microprocessor Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 9 | | EE 353 | MATLAB Programming Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 10 | | EE 355 | Computer Based Power System Lab | 1 | - | - | 2 | 3 | 60 | 40 |
|  | |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 11 | | DC 301 | Discipline and Co-Curricular Activities – V | 2 |  |  |  |  | 100 |  |
|  | |  | **Total** | **28** | **18** | **4** | **8** |  |  |  |
|  | |  | **Total Teaching Load** |  | **30** |  |  |  |  |  |
|  |  |

**Year: III Semester: VI  
 *Note:- Industrial training for 30 days after 6th Semester Exams is compulsory.***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory** |  |  |  |  |  |  |  |
| 1 | EE 302 | Advance Control Theory | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 2 | EE 304 | Modern Power Electronics | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 3 | EE 306 | Power System Protection | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 4 | EE 308 | High Voltage Engineering | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 5 | CP 320 | Data Structures in C | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 6 |  | **Open Elective – 2 (any one of the following)** | 3 | 3 | 0 |  | 3 | 30 | 70 |
|  | EC 314 | Microprocessor and Computer Architecture II |  |  |  |  |  |  |  |
|  | ME 318 | Strength of Materials |  |  |  |  |  |  |  |
|  | IT 304 | Web Technology |  |  |  |  |  |  |  |
|  | EC 316 | Fundamentals of Digital Communication |  |  |  |  |  |  |  |
|  | HS 302 | Employability Skills-IV: Technical Writing |  |  |  |  |  |  |  |
|  |  | **B. Practical’s / Sectionals** |  |  |  |  |  |  |  |
| 7 | EE 352 | Advance Control Lab | 1 |  |  | 2 | 3 | 60 | 40 |
| 8 | PE 302 | Project (Stage I) | 2 |  |  | 2 | 3 | 60 | 40 |
| 9 | EE 354 | Modern Power Electronics Lab | 1 |  |  | 2 | 3 | 60 | 40 |
| 10 | CP 358 | Data Structures lab | 1 |  |  | 2 | 3 | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 11 | DC 302 | Discipline and Co-Curricular Activities – VI | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **28** | **18** | **3** | **8** |  |  |  |
|  |  | **Total Teaching Load** |  | **29** |  |  |  |  |  |



**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme for B-Tech (Electrical Engineering 4 Year Course)**

**Edition 2014**

**Year: IV Semester: VII**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | |  | **A. Theory** |  |  |  |  |  |  |  |
| 1 | | EE 401 | Power System Analysis | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 2 | | EE 403 | Electrical Machine Design | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 3 | | EE 405 | Utilization of Electric Power and Traction | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 4 | | EE 410 | Electrical Engineering Materials | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 5 | | CP 425 | Artificial Intelligence and Neural Networks | 3 | 3 | 0 |  | 3 | 30 | 70 |
|  | |  |  |  |  |  |  |  |  |  |
| 6 | |  | **Deptt. Elective – 3 (any one of the following)** | 4 | 3 | 1 |  | 3 | 30 | 70 |
|  | | EC 407 | Electromagnetic Field Theory |  |  |  |  |  |  |  |
|  | | EE 409 | Distribution of Electrical Power |  |  |  |  |  |  |  |
|  | | EE 411 | Power System Reliability |  |  |  |  |  |  |  |
|  | | HS 401 | Technical Aptitude |  |  |  |  |  |  |  |
|  | |  | **B. Practicals / Sessionals** |  |  |  |  |  |  |  |
| 7 | | EE 457 | Electrical Circuit Lab | 1 |  |  | 2 | 3 | 60 | 40 |
| 8 | | PT 401 | Summer Practical Training Seminar | 1 |  |  | 2 | 3 | 60 | 40 |
| 9 | | PE 401 | Project (Stage II) | 2 |  |  | 2 | 3 | 60 | 40 |
| 10 | | IT 457 | Information Technology Lab | 1 |  |  | 2 | 3 | 60 | 40 |
|  | |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 11 | | DC 401 | Discipline and Co-Curricular Activities | 2 |  |  |  |  | 100 |  |
|  | |  | **Total** | **28** | **18** | **3** | **8** |  |  |  |
|  | |  | **Total Teaching Load** |  | **29** |  |  |  |  |  |
|  |  |

**Year: IV Semester: VIII**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory** |  |  |  |  |  |  |  |
| 1 | EE 402 | Electrical Drives | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 2 | EE 404 | EHV AC/DC Transmission | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 3 | EE406 | Switch Gear and Protection | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 4 | EE 408 | Power System Engineering | 4 | 3 | 1 |  | 3 | 30 | 70 |
|  |  | **B. Practicals / Sessionals** |  |  |  |  |  |  |  |
| 5 | EE 454 | MATLAB Simulation Lab | 2 |  |  | 2 | 3 | 60 | 40 |
| 6 | EE 456 | Electrical Drives and control Lab | 2 |  |  | 2 | 3 | 60 | 40 |
| 7 | EE 458 | High Voltage Engineering lab | 1 |  |  | 2 | 3 | 60 | 40 |
| 8 | SM 402 | B. Tech. Seminar | 2 |  |  | 2 | 3 | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 9 | DC 402 | Discipline and Co-Curricular Activities – VIII | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **23** | **12** | **2** | **10** |  |  |  |
|  |  | **Total Teaching Load** |  | **24** |  |  |  |  |  |

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme for M. Tech. Dual Degree (B. Tech Electrical Engineering + M. Tech. Power System)**

**(5 Year Course)**

**Edition 2014**

**Note: - B.Tech + Dual Degree (Power System Energy Engineering) Syllabus are same up to VI semester of B.Tech syllabus**

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme for Electrical Engineering Dual Degree (B-Tech+ M-Tech ) Power System 5 year course Edition 2014**

**Year: IV Semester: VII**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory** |  |  |  |  |  |  |  |
| 1 | EE 410 | Electrical Engineering Materials | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 2 | EE 401 | Power System Analysis | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 3 | EE 403 | Electrical Machine Design | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 4 | CP 425 | Artificial Intelligence and Neural Networks | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 5 | EE 405 | Utilization of Electric Power and Traction | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 6 | MA 501 | Advanced Mathematics | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 7 |  | **Deptt. Elective – 3 (any one of the following)** | 4 | 3 | 1 |  | 3 | 30 | 70 |
|  | EC 407 | Electromagnetic Field Theory |  |  |  |  |  |  |  |
|  | EE 409 | Distribution of Electrical Power |  |  |  |  |  |  |  |
|  | EE 411 | Power System Reliability |  |  |  |  |  |  |  |
|  | HS401 | Technical Aptitude |  |  |  |  |  |  |  |
|  |  | **B. Practicals / Sessionals** |  |  |  |  |  |  |  |
| 8 | EE 457 | Electrical Circuit Lab | 1 |  |  | 2 | 3 | 60 | 40 |
| 9 | PT 401 | Summer Practical Training and Seminar | 1 |  |  | 2 | 3 | 60 | 40 |
| 10 | PE 401 | Project (Stage II) | 2 |  |  | 2 | 3 | 60 | 40 |
| 11 | IT 457 | Information Technology Lab | 1 |  |  | 2 | 3 | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 12 | DC401 | Discipline and Co-Curricular Activities | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **31** | **21** | **3** | **8** |  |  |  |
|  |  | **Total Teaching Load** |  | **32** |  |  |  |  |  |

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme Electrical Engineering Dual Degree (B.Tech. + M.Tech. Power System 5 year course)**

**Edition 2014**

**Year: IV Semester: VIII**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory** |  |  |  |  |  |  |  |
| 1 | EE 402 | Electrical Drives | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 2 | EE 404 | EHV AC/DC Transmission | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 3 | EE406 | Switch Gear and Protection | 3 | 3 | 0 |  | 3 | 30 | 70 |
| 4 | EE 408 | Power System Engineering | 4 | 3 | 1 |  | 3 | 30 | 70 |
| 5 | EE502 | Power System Stability | 3 | 3 | 0 |  | 3 | 30 | 70 |
|  |  | **B. Practicals / Sessionals** |  |  |  |  |  |  |  |
| 6 | EE 454 | MATLAB Simulation Lab | 1 |  |  | 2 | 3 | 60 | 40 |
| 7 | EE 456 | Electrical Drives and control Lab | 1 |  |  | 2 | 3 | 60 | 40 |
| 8 | EE 458 | High Voltage Engineering lab | 1 |  |  | 2 | 3 | 60 | 40 |
| 9 | SM 402 | B. Tech. Seminar | 2 |  |  | 2 | 3 | 60 | 40 |
|  |  |  |  |  |  |  |  |  |  |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 10 | DC 402 | Discipline and Co-Curricular Activities – VIII | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **32** | **21** | **2** | **10** |  |  |  |
|  |  | **Total Teaching Load** |  | **33** |  |  |  |  |  |

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**Teaching and Examination Scheme for Full-Time Dual Degree (B. Tech Electrical Engineering + M. Tech. Power System) (5 Year Course)**

**Edition 2014**

**Year: IV Summer Semester: IX Summer**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory Papers** |  |  |  |  |  |  |  |
| 1 | EE 504 | HVDC Transmission | 3 | 3 |  | - | 3 | 30 | 70 |
| 2 | EE 506 | Power System Transients and Protection | 3 | 3 |  |  | 3 | 30 | 70 |
| 3 | EE 501 | Power System Analysis | 3 | 3 |  | - | 3 | 30 | 70 |
| 4 |  | **Elective (any one of the following)** | 3 | 3 |  |  | 3 | 30 | 70 |
|  | EE 508 | Advance Power System |  |  |  |  |  |  |  |
|  | MA 502 | Simulation and Modelling |  |  |  |  |  |  |  |
|  | EE 510 | Advanced Circuit Analysis and Design |  |  |  |  |  |  |  |
|  | HS502 | Soft Skills Training II |  |  |  |  |  |  |  |
|  |  | **B. Practical & Sessional:** |  |  |  |  |  |  |  |
| 5 | EE 551 | MATLAB Programming Lab | 2 | - | - | 3 | 3 | 60 | 40 |
| 6 | EE 552 | Power System Modelling and Simulation Lab | 2 | - | - | 3 | 3 | 60 | 40 |
|  |  | **Total** | **16** | **9** | **0** | **6** |  |  |  |
|  |  | **Total Teaching Load** |  | **16\*2=32** |  |  |  |  |  |

**NOTE**\* Since IX Summer semester is of shorter duration each summer course shall be double the teaching hours/week i.e. the above courses shall be of 6 hours/week



**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme for Dual Degree B.Tech (Electrical Engineering) +M.Tech (Power System) 5 year course**

Edition 2014

**Year: V Semester: IX (Regular)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in %)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory Papers** |  |  |  |  |  |  |  |
| 1 | EE 601 | Power System Planning and Reliability | 3 | 3 |  | - | 3 | 30 | 70 |
| 2 | EE 503 | Advanced Power Electronics | 3 | 3 |  | - | 3 | 30 | 70 |
| 3 | EE 603 | Operation and Control of Power System | 3 | 3 |  | - | 3 | 30 | 70 |
| 4 |  | **Elective I (any one of the following)** | 3 | 3 |  |  | 3 | 30 | 70 |
|  | ME 521 | Modelling & Planning of Energy Systems |  |  |  |  |  |  |  |
|  | ME 523 | Wind Energy Utilization |  |  |  |  |  |  |  |
|  | ME 525 | Energy Management |  |  |  |  |  |  |  |
|  | ME 527 | Energy Conservation Technologies |  |  |  |  |  |  |  |
|  | HS 501 | Soft Skills Training I |  |  |  |  |  |  |  |
| 5 |  | **Elective (any one of the following)** | 3 | 3 |  | - | 3 | 30 | 70 |
|  | EE 605 | Advanced Theory and Analysis of AC Machines |  |  |  |  |  |  |  |
|  | EE 607 | Excitation of Synchronous Machines and their Control |  |  |  |  |  |  |  |
|  | EE 608 | **Restructured Power Systems** |  |  |  |  |  |  |  |
|  | CP 617 | AI Applications to Power Systems |  |  |  |  |  |  |  |
|  | HS 601 | Soft Skills Training III |  |  |  |  |  |  |  |
|  |  | **B. Practical & Sessional:** |  |  |  |  |  |  |  |
| 6 | EE 653 | Seminar | 5 | - | - | 3 | 2 | 60 | 40 |
| 7 | EE 651 | Computer Based Power System Design Lab | 2 | - | - | 3 | 3 | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 8 | DC 601 | Discipline and Co-Curricular Activities – VIII | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **24** | **15** | **0** | **6** |  |  |  |
|  |  | **Total Teaching Load** |  | **21** |  |  |  |  |  |

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme Electrical Engineering Dual Degree (B.Tech+ M.Tech Power System 5 year course)**

Edition 2014

**Year: V Semester: X**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in %)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **B. Practical & Sessional:** |  |  |  |  |  |  |  |
| 1 | DI 602 | M. Tech. Dissertation / Thesis | 16 | 0 | 0 | 3 |  | 60 | 40 |
|  |  |  |  |  |  |  |  |  |  |
|  |  | **Total** | **16** | **0** | **0** | **3** |  |  |  |
|  |  | **Total Teaching Load** |  | **3** |  |  |  |  |  |

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Power System)**

**Edition 2014**

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Power System)**

**Edition 2014**

**Year I Semester – I**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory Papers** |  |  |  |  |  |  |  |
| 1 | EE 501 | Power System Analysis | 3 | 3 |  | - | 3 | 30 | 70 |
| 2 | MA501 | Advanced Mathematics | 3 | 3 |  | - | 3 | 30 | 70 |
| 3 | EE 503 | Advanced Power Electronics | 3 | 3 |  | - | 3 | 30 | 70 |
| 4 |  | **Elective I (any one of the following)** | 3 | 3 |  |  | 3 | 30 | 70 |
|  | ME 521 | Modelling & Planning of Energy Systems |  |  |  |  |  |  |  |
|  | ME 523 | Wind Energy Utilization |  |  |  |  |  |  |  |
|  | ME 525 | Energy Management |  |  |  |  |  |  |  |
|  | ME 527 | Energy Conservation Technologies |  |  |  |  |  |  |  |
|  | HS 501 | Soft Skills Training I |  |  |  |  |  |  |  |
|  |  | **B. Practical & Sessional:** |  |  |  |  |  |  |  |
| 5 | EE 551 | MATLAB Programming Lab | 2 | - | - | 3 | 3 | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 6 | DC501 | Discipline and Co-Curricular Activities | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **16** | **12** | **0** | **3** |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  | **Total Teaching Load** |  | **15** |  |  |  |  |  |
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**Year I Semester – II**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory Papers** |  |  |  |  |  |  |  |
| 1 | EE 502 | Power System Stability | 3 | 3 |  | - | 3 | 30 | 70 |
| 2 | EE 504 | HVDC Transmission | 3 | 3 |  | - | 3 | 30 | 70 |
| 3 | EE 506 | Power System Transients and Protection | 3 | 3 |  |  | 3 | 30 | 70 |
| 4 |  | **Elective (any one of the following)** | 3 | 3 |  |  | 3 | 30 | 70 |
|  | EE 508 | Advance Power System |  |  |  |  |  |  |  |
|  | MA 502 | Simulation and Modelling |  |  |  |  |  |  |  |
|  | EE 510 | Advance Circuit Analysis and Design |  |  |  |  |  |  |  |
|  | HS 502 | Soft Skills Training II |  |  |  |  |  |  |  |
|  |  | **B. Practical & Sessional:** |  |  |  |  |  |  |  |
| 5 | EE 552 | Power System Modelling and Simulation Lab | 2 | - | - | 3 | 3 | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 6 | DC 502 | Discipline and Co-Curricular Activities | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **16** | **12** | **0** | **3** |  |  |  |
|  |  | **Total Teaching Load** |  | **15** |  |  |  |  |  |

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**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching and Examination Scheme for M. Tech. FULL-TIME (Core) (Power System)**

**Edition 2014**

**Year II Semester – III**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Theory Papers** |  |  |  |  |  |  |  |
| 1 | EE 601 | Power System Planning and Reliability | 3 | 3 |  | - | 3 | 30 | 70 |
| 2 | EE 603 | Operation and Control of Power System | 3 | 3 |  | - | 3 | 30 | 70 |
| 3 |  | **Elective (any one of the following)** | 3 | 3 |  | - | 3 | 30 | 70 |
|  | EE 605 | Advanced Theory and Analysis of AC Machines |  |  |  |  |  |  |  |
|  | EE 607 | Excitation of Synchronous Machines and their Control |  |  |  |  |  |  |  |
|  | CP 617 | AI Applications to Power Systems |  |  |  |  |  |  |  |
|  | HS 503 | Soft Skills Training III |  |  |  |  |  |  |  |
|  | EE 608 | **Restructured Power Systems** |  |  |  |  |  |  |  |
|  |  | **B. Practical & Sessional:** |  |  |  |  |  |  |  |
| 4 | EE 653 | Computer Based Power System Design Lab | 2 | - | - | 3 | 3 | 60 | 40 |
| 5 | EE 651 | M.Tech Seminar | 5 | - | - | 3 | 3 | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
| 6 | DC 601 | Discipline and Co-Curricular Activities | 2 |  |  |  |  | 100 |  |
|  |  | **Total** | **18** | **09** | **0** | **6** |  |  |  |
|  |  | **Total Teaching Load** |  | **15** |  |  |  |  |  |

**Year II Semester – IV**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Practical & Sessional:** |  |  |  |  |  |  |  |
| 1 | DI 602 | M. Tech. Dissertation / Thesis | 16 | 0 | 0 | 3 |  | 60 | 40 |
|  |  | **C. Discipline and Co-Curricular Activities** |  |  |  |  |  |  |  |
|  |  | **Total** | **16** | **0** | **0** | **3** |  |  |  |
|  |  | **Total Teaching Load** |  | **3** |  |  |  |  |  |

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| **GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY** | | | | | | | | | |
| **DEPARTMENT OF ELECTRICAL ENGINEERING** | | | | | | | | | |
| **LIST OF COURSES OFFERED** | | | | | | | | | |
|
| **Course Code** | **Course Name** | | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
| **ELECTRICAL ENGINEERING** | | | | | | | | | |
| EE 201 | Electrical Measurement and Instrumentation | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| EE 202 | Network Theory –II | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| EE 203 | Network Theory –I | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| EE 204 | Electro Mechanical Energy Conversion ­­–II | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| EE 205 | Electro Mechanical Energy Conversion ­­–I | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| EE 206 | Generation of Electrical Power. | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| EE 207 | Non-Conventional Energy Systems | | - | - | - | - | - | - | - |
| EE 208 | Advance Electrical Machines | | - | - | - | - | - | - | - |
| EE 209 | Electrical Engineering Materials | | - | - | - | - | - | - | - |
| EE 251 | Electrical Measurement and Instrumentation Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EE 252 | Electro Mechanical Energy Conversion ­­–II Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EE 253 | Electro-Mechanical Energy Conversion ­­–I Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EE 255 | Electrical Engineering Drawing | | 1 | - | - | 2 | 3 | 60 | 40 |
| EE 301 | Power Electronics | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| EE 302 | Advance Control Theory | | 4 | 3 | 1 |  | 3 | 30 | 70 |
| EE 303 | Control Theory | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| EE 304 | Modern Power Electronics | | 4 | 3 | 1 |  | 3 | 30 | 70 |
| EE 305 | Transmission and Distribution of Electrical Power. | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| EE 306 | Power System Protection | | 4 | 3 | 1 |  | 3 | 30 | 70 |
| EE 307 | Power System Instruments | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EE 308 | High Voltage Engineering | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EE 351 | Power Electronics Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EE 352 | Advance Control Lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| EE 353 | MATLAB Programming Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EE 354 | Modern Power Electronics Lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| EE 355 | Computer Based Power System Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EE 401 | Power System Analysis | | 4 | 3 | 1 |  | 3 | 30 | 70 |
| EE 402 | Electrical Drives | | 4 | 3 | 1 |  | 3 | 30 | 70 |
| EE 403 | Electrical Machine Design | | 4 | 3 | 1 |  | 3 | 30 | 70 |
| EE 404 | EHV AC/DC Transmission | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EE 405 | Utilization of Electric Power and Traction | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EE 406 | Switch Gear and Protection | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| EE 407 | Electromagnetic Field Theory | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EE 408 | Power System Engineering | | 4 | 3 | 1 |  | 3 | 30 | 70 |
| EE 409 | Distribution of Electrical Power | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EE410 | Electrical engineering materials | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EE 411 | Power System Reliability | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EE 454 | MATLAB Simulation Lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| EE 456 | Electrical Drives and control Lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| EE 457 | Electrical circuit Lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| EE 458 | High Voltage Engineering lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| EE 501 | Power System Analysis | | 3 | 3 |  | - | 3 | 30 |  |
| EE 502 | Power System Stability | | 3 | 3 |  | - | 3 | 30 | 70 |
| EE503 | Advance Power Electronics | | 3 | 3 |  |  | 3 | 30 | 70 |
| EE 504 | HVDC Transmission | | 3 | 3 |  | - | 3 | 30 | 70 |
| EE 506 | Power System Transients and Protection | | 3 | 3 |  |  | 3 | 30 | 70 |
| EE 508 | Advance Power System | |  |  |  |  |  |  |  |
| EE 510 | Advanced Circuit Analysis and Design | |  |  |  |  |  |  |  |
| EE 551 | MATLAB Programming Lab | | 2 | - | - |  | 3 | 60 | 40 |
| EE 552 | Power System Modelling And Simulation Lab | | 2 |  |  |  | 3 | 60 | 40 |
| EE 601 | Power System Planning and Reliability | | 3 | 3 |  | - | 3 | 30 | 70 |
| EE 603 | Operation And Control of Power System | | 3 | 3 |  |  | 3 | 30 | 70 |
| EE 605 | Advance Theory And Analysis of AC Machine | | 3 | 3 |  |  | 3 | 30 | 70 |
| EE607 | Excitation of Synchronous Machine And Their Control | | 3 | 3 |  |  | 3 | 30 | 70 |
| EE 608 | **Restructured Power Systems** | | 3 | 3 |  | - | 3 | 30 | 70 |
| EE 653 | Computer based power system design lab | | 4 | - | - | 8 | 3 | 60 | 40 |
| **PROJECT** | | | | | | | | | |
| PE 302 | Project Stage – I | | 2 |  |  |  |  | 60 | 40 |
| PE 401 | Project Stage – II | | 2 |  |  |  |  | 60 | 40 |
| **DISSERTATION** | | | | | | | | | |
| D1 602 | M.Tech Dissertation / Thesis | | **16** | **-** | **-** | **-** | **3** | **60** | **40** |
| **SEMINAR** | | | | | | | | | |
| SM 402 | B. Tech Seminar | | 2 | - | - | 2 | 2 | 60 | 40 |
| PT 401 | Summer Practical Training Seminar | | 2 | - | - | 2 | 2 | 60 | 40 |
| EE 651 | M.Tech Seminar | | 5 |  |  |  | 9 | 60 | 40 |
| **DISCIPLINE** | | | | | | | | | |
| DC 201 | Discipline and Co-Curricular Activities – III | | **2** |  |  |  |  | **100** |  |
| DC 202 | Discipline and Co-Curricular Activities – IV | | **2** |  |  |  |  | **100** |  |
| DC 301 | Discipline and Co-Curricular Activities – V | | **2** |  |  |  |  | **100** |  |
| DC 302 | Discipline and Co-Curricular Activities – VI | | **2** |  |  |  |  | **100** |  |
| DC 401 | Discipline and Co-Curricular Activities – VII | | **2** |  |  |  |  | **100** |  |
| DC 501 | Discipline and Co-Curricular Activities – I | | **2** |  |  |  |  | **100** |  |
| DC 502 | Discipline and Co-Curricular Activities – II | | **2** |  |  |  |  | **100** |  |
| DC 601 | Discipline and Co-Curricular Activities – III | | **2** |  |  |  |  | **100** |  |
| **BUSSINESS MANAGEMENT** | | | | | | | | | |
| BM 402 | Entrepreneurship and Management | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| **COMPUTER ENGINEERING** | | | | | | | | | |
| CP 262 | Computer Programming Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| CP 320 | Data Structures in C | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| CP 358 | Data Structures lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| CP 423 | Data Base Management system | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| CP 425 | Artificial Intelligence and Neural Networks | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| CP 457 | Data Base Management system Lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| CP 607 | AI Applications to Power Systems | | 3 | 3 |  |  | 3 | 30 | 70 |
| **ELECTRONICS AND COMMUNICATION** | | | | | | | | | |
| EC 212 | Advanced Electronics | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| EC 204 | Digital Electronics | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| EC 221 | Basic Electronics | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| EC 252 | Advanced Electronics Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EC 253 | Electronics Devices and Circuits Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EC 254 | Digital Electronics Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EC 314 | Microprocessor and Computer Architecture II | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EC 315 | Micro Processor and Computer Architecture | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| EC 316 | Fundamentals of Digital Communication | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| EC 317 | Principle of Communication Systems | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| EC 355 | Microprocessor Lab | | 1 | - | - | 2 | 3 | 60 | 40 |
| EC 325 | Embedded Systems | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| **INFORMATION TECHNOLOGY** | | | | | | | | | |
| IT 304 | Web Technology | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| IT 457 | Information Technology Lab | | 1 |  |  | 2 | 3 | 60 | 40 |
| **MATHEMATICS** | | | | | | | | | |
| MA 201 | Integral Transforms & Complex Analysis | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| MA 202 | Numerical Analysis and Statistics | | 4 | 3 | 1 | - | 3 | 30 | 70 |
| MA502 | Simulation and Modelling | | 3 | 3 |  |  | 3 | 30 | 70 |
| MA 305 | Operation Research | | 3 | 3 | 0 | - | 3 | 30 | 70 |
| MA 501 | Advanced Mathematics | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| **MECHANICAL ENGINEERING** | | | | | | | | | |
| ME 521 | | Modelling & Planning of Energy Systems | 3 | 3 | 0 |  | 3 | 30 | 70 |
| ME 523 | | Wind Energy Utilization | 3 | 3 | 0 |  | 3 | 30 | 70 |
| ME 525 | | Energy Management | 3 | 3 | 0 |  | 3 | 30 | 70 |
| ME 527 | | Energy Conservation Technologies | 3 | 3 | 0 |  | 3 | 30 | 70 |
| ME 318 | | Strength of Materials | 3 | 3 | 0 |  | 3 | 30 | 70 |
| **SOFT SKILLS** | | | | | | | | | |
| HS 201 | Communication Skill | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| HS 202 | Cognitive Skill | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| HS 301 | Verbal Non-Verbal Reasoning | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| HS 302 | Employability Skills-IV: Technical Writing | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| HS 401 | Technical Aptitude | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| HS 501 | Soft Skills Training I | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| HS-502 | Soft Skills Training II | | 3 | 3 | 0 |  | 3 | 30 | 70 |
| HS-601 | Soft Skills Training III | | 3 | 3 | 0 |  | 3 | 30 | 70 |

**EE-201 MEASUREMENT AND INSTRUMENTATION C(L,T,P) = 4(3 ,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| I | **Principles of Measurement:** Moving coil, moving iron, electrodynamics and induction instruments-construction, operation, torque equation and errors. Applications of instruments for measurement of current, voltage, single-phase power and single-phase energy. Errors in wattmeter and energy meter and their compensation and adjustment. Testing and calibration of single-phase energy meter by phantom loading. | **6** |
| II | **Polyphase Metering:** Blondel's Theorem for n-phase, p-wire system. Measurement of power and reactive kVA in 3-phase balanced and unbalanced systems: One-wattmeter, two-wattmeter and three-wattmeter methods. 3-phase induction type energy meter. Instrument Transformers: Construction and operation of current and potential transformers. Ratio and phase angle errors and their minimization. Effect of variation of power factor, secondary burden and frequency on errors. Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy. | **6** |
| III | **Potentiometers:** Construction, operation and standardization of DC potentiometers– slide wire and Compton potentiometers. Use of potentiometer for measurement of resistance and voltmeter and ammeter calibrations. Volt ratio boxes. Construction, operation and standardization of AC potentiometer – in-phase and quadrature potentiometers. Applications of AC potentiometers. | **8** |
| IV | **Measurement of Resistances:**Classification of resistance. Measurement of medium resistances – ammeter and voltmeter method, substitution method, Wheatstone bridge method. Measurement of low resistances – Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Price's Guard-wire method. Measurement of earth resistance. | **8** |
| V | **Bridge Measurements:** Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge and Anderson bridge for self-inductance measurement. Heaviside's bridge for mutual inductance measurement. De Sauty Bridge for capacitance measurement. Wien's bridge for capacitance and frequency measurements. Sources of error in bridge measurements and precautions. Screening of bridge components. Wagner earth device. | **8** |

**References:**

1) Electrical and Electronics measurements and measuring instruments. A.K.SAWAHNEY-DhanpatRai and Sons.

2) Electrical measurements by E.W.Golding.

3) A course in Electronics and Electrical measurements and instrumentation by J.B.GUPTA-Kataria Publications.

4) Electrical measurements and measuring instruments by Rajendra Prasad-Khanna Publishers.

**EE 202 CIRCUIT THEORY II C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Impedance and Admittance Functions:** The concept of complex frequency, transform impedance and admittance, series and parallel combinations.  **Network Functions:** Terminals and terminal pairs, driving point impedance transfer functions, poles and zeros. Restrictions on pole and zero location in s-plane. Time domain behavior from pole and zero plot. Procedure for finding network functions for general two terminal pair networks. | **6** |
| **II** | **Network Synthesis:** Hurwitz polynomial, positive real functions, reactive networks. Separation property for reactive networks. The four-reactance function forms, specification for reactance function. Foster form of reactance networks. Cauer form of reactance networks. Synthesis of R-L and R-C networks in Foster and Cauer forms. | **6** |
| **III** | **Two Port General Networks:** Two port parameters (impedance, admittance, hybrid, ABCD parameters) and their inter relations. Equivalence of two ports. Transformer equivalent, inter connection of two port networks. The ladder network, image impedance, image transfer function, application to L-C network, attenuation and phase shift in symmetrical T and **π** networks. | **8** |
| **IV** | **Two Port Reactive Network (Filters):**Constant K filters. The m-derived filter. Image impedance of m-derived half (or L) sections, composite filters. Band pass and band elimination filters. The problem of termination, lattice filters, Barlett’s bisection theorem. Introduction to active filters. | **8** |
| **V** | **Coupled Circuits:** Conductively coupled circuits. Mutual impedance, magnetic coupling, mutual inductance, co-efficient of magnetic coupling, circuit directions and sign of mutual inductance, mutual inductance between portions of the same circuit, mutual inductance between parallel branches, transferred impedance. Transformer equivalent inductively and conductively coupled circuits; Resonance in Single tuned and Double tuned circuits, effect of coefficient of coupling. | **8** |

**References:**

1) M.E. Van Valkenberg, ‘Network Analysis’ Prentice Hall

2) D. Roy Choudhary, ‘Networks and Systems’

3) W. H. Hayt and J. E. Kemmerly, Engineering circuit Analysis, TATA MCGRAW HILL

4) A Chakrabarti and S. Bhadra, ‘Networks and Systems’ DhanpatRai and Co

**EE-203 CIRCUIT THEORY - I** **C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Network classification and Introduction to continuous time signals and systems**: Unit Step, ramp and impulse signals, Example of each signal, Differential Equation Formulation of linear time invariant continuous system, Responses for unit ramp, square pulse and impulse function. | **6** |
| **II** | **Review of Laplace Transform**: Initial value and Final Value Theorem, Properties and solution of differential equation using LT, Time domain analysis of LTI network using Laplace transform, Waveform Synthesis, LT of Complex waveforms, Concept of Transform Impedance, voltage ratio, transfer function, Relation between impulse response and system function. | **6** |
| **III** | **Networks Theorems:** Maximum power transfer Theorem, Superposition, Telligen’s, Milliman’s, Thevenin’s and Norton’s Theorem, Concept of poles and zeros, Relation between location of poles, time response and stability. | **8** |
| **IV** | **Two port networks :** Two port network parameters (z, y, T, T’, h, g), Symmetrical and Reciprocal networks, Inter-conversion of two port network parameters, Interconnection of two port networks, ,Ladder networks, T- transformation, Image and characteristic impedance. Network functions: Driving point and Transfer functions. | **8** |
| **V** | **Positive real function:**Definition and properties, Synthesis of LC, RL and RC circuits using Cauer and Foster’ s first and second form. | **8** |

**References:**

1) M.E. Van Valkenberg, ‘Network Analysis’ Prentice Hall

2) D. Roy Choudhary, ‘Networks and Systems’

3) W. H. Hayt and J. E. Kemmerly, Engineering circuit Analysis, TATA MCGRAW HILL

4) A Chakrabarti and S. Bhadra, ‘Networks and Systems’ DhanpatRai and Co.

**EE 204 ELECTRO MECHANICS – II C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction:** General equation of inducted emf, AC armature windings: concentric and distributed winding, chording, skewing, effect on induced emf. Armature and field mmf, effect of power factor and current on armature mmf, harmonics. Rotating fields. | **6** |
| **II** | **Induction Motors:** Construction of squirrel cage and slip ring induction motor, basic principles, flux and mmf waves, induction motor as a transformer. Equivalent circuits, torque equation, torque-slip curves, no load and block rotor tests, circle diagram, performance calculation. Effect of rotor resistance. Cogging, Crawling. Double cage squirrel cage induction motor, induction generator, induction regulator. | **6** |
| **III** | **Starting and Speed Control of Induction Motors:** Various methods of starting and speed control of squirrel cage and slip ring motor, cascade connection, braking.**Single-Phase Induction Motor:** Revolving field theory, starting methods, equivalent circuits. | **8** |
| **IV** | **Synchronous Generator:** Construction, types, excitation systems, principles. Equation of induced emf, flux and emf waves, theory of cylindrical rotor and salient pole machines, tworeactance theory, phasor diagrams, power developed, voltage regulation, OC and SC tests, zero power factor characteristics, potier triangle and ASA method of finding voltage regulation, synchronization, parallel operation, hunting and its prevention. | **8** |
| **V** | **Synchronous Motors:** types, construction, principle, phasor diagrams, speed torque characteristics, power factor control, V-curves, starting methods, performance calculations, applications, synchronous condenser, synchronous induction motor. | **8** |

**References:**

1) P.S.Bimbhra, Electrical Machinery, 2000, Khanna publishers New Delhi.

2) J.Nagrath and D.P.Kothari, Electrical Machines 2000, TATA MCGRAW HILL Publication New Delhi.

3) P.S.Bimbhra, Generalized theory of Electrical Machine, 1996, Khanna publishers, New Delhi.

4) GopalK.Dubey, Fundamental of Electrical Drives, 2001 Narosa Publishing House, New Delhi

5) Fitzrald,Kingsley and umans Electrical Machines 2000, TATA MCGRAW HILL Publication New Delhi.

6) Advance Electrical Technologies by H.Cotton

**EE-205 ELECTRO MECHANICS - I C(L.T.P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Electromechanical Energy Conversion:** Basic principles of electromechanical energy conversion. Basic aspects and physical phenomena involved in energy conversion. Energy balance. | **6** |
| **II** | **DC generators**: Construction, Types of DC generators, emf equation, lap and wave windings, equalizing connections, armature reaction, commutation, methods of improving commutations, demagnetizing and cross magnetizing mmf, interpoles, characteristics, parallel operation. Rosenberg generator. | **6** |
| **III** | **DC Motors:** Principle, back emf, types, production of torque, armature reaction and interpoles, characteristics of shunt, series and compound motor, DC motor starting. Speed Control of DC Motor: Armature voltage and field current control methods, Ward Leonard method. Braking, losses and efficiency, direct and indirect test, Swinburne’s test, Hopkinsion test, field and retardation test, single-phase series motor. | **8** |
| **IV** | **Transformers:** Construction, types, emf equation. No load and load conditions. Equivalent circuits, Vector diagrams, OC and SC tests, Sumpner’s back-to-back test, efficiency. Voltage regulation, effect of frequency, parallel operation, autotransformers, switching currents in transformers, separation of losses. | **8** |
| **V** | **Polyphase Transformers:** Single unit or bank of single-phase units, polyphase connections, Open delta and V connections, Phase conversion: 3 to 6 phase and 3 to 2 phase conversions, Effect of 3-phase winding connections on harmonics, 3-phase winding transformers, tertiary winding. | **8** |

**References:**1.) P.S.Bimbhra, Electrical Machinery, 2000, Khanna publishers New Delhi.

2. )J.Nagrath and D.P.Kothari, Electrical Machines 2000, TATA MCGRAW HILL Publication New Delhi.

3. )P.S.Bimbhra, Generalized theory of Electrical Machine, 1996, Khanna publishers, New Delhi.

4. )GopalK.Dubey, Fundamental of Electrical Drives, 2001 Narosa Publishing House, New Delhi

5. )Fitzrald,Kingsley and umans Electrical Machines 2000, TATA MCGRAW HILL Publication New Delhi.

6. ) Advance Electrical Technologies by H.Cotton

**EE206 GENERATION OF ELECTRICAL POWER C(L.T.P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Conventional Energy Generation Methods**:   1. **Thermal Power plants:** Basic schemes and working principle. 2. **Gas Power Plants:** open cycle and closed cycle gas turbine plants, combined gas & steam plants – basic schemes. 3. **Hydro Power Plants:** Classification of Hydro electric plants. Basic schemes of hydro electric and pumped storage plants. 4. **Nuclear Power Plants:** Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies   of various power plants. | **6** |
| **II** | **New Energy Sources**: Impact of thermal, gas, hydro and nuclear power stations on environment. Green House Effect (Global Warming). Renewable and non-renewable energy sources. Conservation of natural resources and sustainable energy systems. Indian energy scene. Introduction of electric energy generation by wind, solar and tidal. | **6** |
| **III** | 1. **Loads and Load curves:** Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization 2. **Power factor improvement**: Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers. | **8** |
| **IV** | **Power Plant Economics:**   1. Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost. Role of load diversity in power system economics. 2. Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. 3. **Energy cost reduction:** off peak energy utilization, co-generation, and energy conservation. | **8** |
| **V** | **(i) Tariffs:** Objectives of tariffs. General tariff forms. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, three-part tariff. Spot (time differentiated) pricing.  **(ii) Selection of Power Plants:** Comparative study of thermal, hydro, nuclear and gas power plants. Base load and peak load plants. Size and types of generating units, types of reserve and size of plant. Selection and location of power plants. | **8** |

**References:**

1. Generation of Electric Energy B.R. Gupta, S.Chand Publishers

2. Power Plant Engineering Dom Kundwar.

3. Power Plant Engineering R. K. Rajput.

4. Power System Engineering A. Chakrabarti, M. L. Soni, P. V.Gupta, U.S. Bhatnagar.

**EE 207 NON CONVENTIONAL ENERGY SYSTEMS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | (i) **Introduction**: World energy situation, conventional and non-conventional energy sources, Indian energy scene. (ii) **Tidal Energy**: Introduction to tidal power. Components of tidal power plants, double basin arrangement. Power generation. Advantages and limitations of tidal power generation. Prospects of tidal energy in India. | **6** |
| **II** | **Solar Energy:** Solar radiation, solar radiation geometry, solar radiation on tilted surface. Solar energy collector. Flat- plate collector, concentrating collector – parabolidal and heliostat. Solar pond. Basic solar power plant. Solar cell, solar cell array, basic photo-voltaic power generating system,Pyroheliometer,pyronometer. | **6** |
| **III** | **(i) Wind Energy:** Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, towers, generators, control and monitoring components. Basic electric generation schemes- constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes. Applications of wind energy. **(ii) Geothermal Energy:** Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy. Applications of geothermal energy. Geothermal energy in India. | **8** |
| **IV** | **Nuclear Fusion Energy:** Introduction, nuclear fission and nuclear fusion. Requirements for nuclear fusion. Plasma confinement - magnetic confinement and inertial confinement. Basic Tokamak reactor, laser fusion reactor. Advantages of nuclear fusion. Fusion hybrid and cold fusion. | **8** |
| **V** | **Biomass Energy:** Introduction, biomass categories, bio-fuels. Introduction to biomass conversion technologies. Biogas generation, basic biogas plants-fixed dome type, floating gasholder type, DeenBandhu biogas plant, Pragati design biogas plant. Utilization of bio gas. Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production. | **8** |

**References:**

1) S.P.Sukhatme-Solar Energy

2) Dr.A.N.Mathur-Non Conventional resources of Energy

3) B.R.Gupta-Generation of Electrical Energy

4) Arora and Domkundwar-Power Plant Engineering.

**EE 208 ADVANCED ELECTRICAL MACHINES C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **SYNCHRONOUS MACHINE** : Transient behavior, Reactances and time constants, symetric short circuit concept of stability and equal area criteria. | **6** |
| **II** | **SPECIAL MACHINES** :Linear induction motor, Reluctance motor, hystersis motor, stepper motor, homo polar machines, Brushless motor. Concept of Vector Controlled Motors. | **6** |
| **III** | **TRANSFORMERS** : There phase transformers connections and phasor groups, three phase to 6 phase and twelve phase conversion, transformer transients, over voltages in transformers | **8** |
| **IV** | **LINEAR TRANSFORMATIONS IN MACHINES**: Invariance of power transformations from a displaced brush axis, transformations from 3 phase to 2 phase (a, b, c to α, β, 0), transformations from rotating axes to stationery axes (d, q, 0). Physical concept of Park’s transformations. | **8** |
| **V** | **ADVANCE TOPICS IN TRANSFORMERS**: Excitation phenomenon in transformers (Harmonics in 1phase and 3 phase transformers using differential connections suppression of harmonics), Unbalanced operation of 3phase transformer open delta or V connection. Testing of 3phase transformer bank for proper connections. | **8** |

**Reference:**  
1) P S Bimbhra Generalised Theory of Electrical Machines, Khanna Publishers.   
2) A E Fitzgerald. Charles Kingsley, Jr. and S D Umans, Electrical Machinery, 4th Ed., MGH Publishers.   
3) C V Jones Unified Theory of Electrical Machines, Butterworths, London 1967

# EE 251 MEASUREMENTS AND INSTRUMENTATION LABORATORY C(L,T,P) = 1(0,0,1)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. and (ii) C.R.O. Probes |  |
| **II** | Study working and applications of Meggar, Tong-tester, P.F. Meter and Phase Shifter. |  |
| **III** | Measure power and power factor in 3-phase load by (i) Two-wattmeter method and (ii) One wattmeter method. |  |
| **IV** | Calibrate an ammeter using DC slide wire potentiometer. |  |
| **V** | Calibrate a voltmeter using Crompton potentiometer. |  |
| **VI** | Measure low resistance by Crompton potentiometer. |  |
| **VII** | Measure Low resistance by Kelvin's double bridge. |  |
| **VIII** | Measure earth resistance using fall of potential method. |  |
| **IX** | Calibrate a single-phase energy meter by phantom loading at different power factors. |  |
| **X** | Measure self-inductance using Anderson's bridge. |  |
| **XI** | Measure capacitance using De Sauty Bridge. |  |
| **XII** | Measure frequency using Wein's bridge. |  |

# EE 252 Electro-MechanicS II LABORATORY C(L,T,P) = 1(0,0,1)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Separation of transformer core losses and to determine the hysteresis and eddy current losses at rated voltage and frequency |  |
| **II** | To plot the O.C.C. and S.C.C. of an alternator and to determine its regulation by synchronous impedance method. |  |
| **III** | To synchronize an alternator across the infinite bus (RSEB) and summarize the effects of variation of excitation on load sharing |  |
| **IV** | To plot the V-curve for a synchronous motor for different values of loads |  |
| **V** | To perform sumpner’s back-to-back test on 3 phase transformers, find its efficiency and parameters for its equivalent circuits |  |
| **VI** | To perform the heat run test on a delta/delta connected 3-phase transformer and determine the parameters for its equivalent circuit |  |
| **VII** | To perform no load and blocked rotor test on a 3 phase induction motor and to determine the parameters of it equivalent circuits. Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slip (iv) p.f. (v) Efficiency. |  |
| **VIII** | To perform the load test on a 3-phase induction motor and determine its performance characteristics (a) Speed vs load curve (b) p.f. vs load curve (c) Efficiency vs load curve (d) Speed vs torque curve |  |
| **IX** | Determination of losses and efficiency of an alternator. |  |
| **X** | To find Xd and Xq of a salient pole synchronous machine by slip test. |  |

# EE 253 Electro-MechanicS I ­­ LabORATORY C(L,T,P) = 1(0,0,1)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Speed control of D.C. shunt motor by (a) Field current control method and plot the curve for speed vs field current. (b) Armature voltage control method and plot the curve for speed vs armature voltage. |  |
| **II** | Speed control of a D.C. Motor by Ward Leonard method and to plot the curve for speed vs applied armature voltage. |  |
| **III** | To determine the efficiency of D.C. Shunt motor by loss summation (Swinburne’s) method. |  |
| **IV** | To determine the efficiency of two identical D.C. Machine by Hopkinson’s regenerative test. |  |
| **V** | To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency. |  |
| **VI** | To perform back-to-back test on two identical 1-phase transformers and find their efficiency and parameters of the equivalent circuit. |  |
| **VII** | To perform parallel operation of two 1-phase transformers and determine their load sharing. |  |
| **VIII** | To perform the load test on single phase D.C. generator. |  |
| **IX** | To perform OC and SC test on a 3-phase transformer and find its efficiency and parameters of its equivalent circuit |  |
| **X** | To perform parallel operation of two 3-phase transformers and determine their load sharing |  |
| **XI** | To study the performance of 3-phase transformer for its various connections, i.e. star/star star/delta delta/star and delta/delta and find the magnitude of 3rd harmonic current |  |

# EE 255 Electrical Engineering Drawing LABC(L,T,P) = 1(0,0,1)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Explain and draw different types of wiring manually or/and using AUTOCAD software. |  |
| **II** | Explain and draw different types of joints used in electrical wiring manually or/and using AUTOCAD software |  |
| **III** | Explain and draw different types of winding (of DC generator) manually or/and using AUTOCAD software |  |
| **IV** | Explain and draw different types of cores of transformer manually or/and using any software. |  |
| **V** | Make estimation and costing of a new building of shopping mall/installation from electrical point of view. |  |

**EE 301 POWER ELECTRONICS C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Power Semiconductor Devices:** Characteristics of Power Transistor, Thyristor, GTO, Power MOSFET and IGBT. Two-Transistor Model of Thyristor. | **6** |
| **II** | **SCR:** Construction and characteristics, specification and ratings, pulse transformer, optical isolators, methods of turn on: R, RC, UJT relaxation oscillator, Rating extension by series and parallel connections, string efficiency. Protection of SCR-Protection against over voltage, over current, dv/dt, di/dt, Gate protection. | **6** |
| **III** | **Converters-I:** Single Phase half and full wave converters with RL load, Single phase dual converters, Three phase half wave converters, Three phase full converters with RL load, Three phase dual converters. | **8** |
| **IV** | **Converters-II:** Single and three-phase semi converters with RL load. Power Factor Improvement-Extinction angle control, symmetrical angle control, pulse width modulation control and sinusoidal pulse width modulation control. Inversion operation. Effect of load and source impedances. | **8** |
| **V** | **DC-DC Converters: Choppers:** Step Up/Down Copper, Chopper Configurations, analysis of type A Chopper Commutation of Choppers. Switched Mode Regulators-buck, boost, buckboost and cuk regulator. | **8** |

**References:**

1) M.H Rashid:Power Electronics, circuits devices and applications, PRENTICE HALL OF INDIA. ,1988.

2) V Subrahmanyam:Power electronics, New Age Inc.Publishers,New Delhi,1996

3) P.C. Sen:Power electronics Tata McGraw-Hill 1987

4) CW Lander:Power electronics,2nd edition, McGrawHill 1987

5) P.S Bimbhra:Power electronics, 2nd Ed. Khanna Publishers,1987

6) M.D.Singh and K.B. Khanchandani:Power electronics, TATA MCGRAW HILL,1999

**EE 302 ADVANCED CONTROL THEORY C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction:** Concept of Linear vector space Linear Independence, Bases and Representation, domain and range. Concept of Linearity, relaxedness, time invariance, causality. | **6** |
| **II** | **State Space Approach of Control System Analysis:** Modern Vs conventional control theory, concept of state, state variable state vector, state space, state space equations, Writing state space equations of mechanical, Electrical systems, Analogous systems. | **6** |
| **III** | **State Space Representation using physical and phase variables:** comparison form of system representation. Block diagram representation of state model. Signal flow graph representation. State space representation using canonical variables. Diagonal matrix. Jordan canonical form, Derivation of transfer function from state-model. | **8** |
| **IV** | **Solution of State Equations:** Digitalization, Eigenvalues and eigen vectors. Matrix exponential, State transition matrix, Properties of state transition matrix. Computation of State transition matrix concepts of controllability and observability. Pole placement by state feedback, Ackerman’s formula. | **8** |
| **V** | **Digital Control Systems:** Introduction, sampled data control systems, signal reconstruction, difference equations. The z-transform, Z-Transfer Function. Block diagram analysis of sampled data systems, z and s domain relationship, digital PID controller. | **8** |

**Reference:**

1) I J Nagrath and M Gopal : Control systems Engineering, 3rd Ed, New Age Publication.

2) Katsuhiko Ogata:Modern control engineering. PRENTICE HALL OF INDIA.

**EE 303 CONTROL THEORY C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction:** Elements of control systems, concept of open loop and closed loop systems., Examples and application of open loop and closed loop systems, brief idea of multivariable control systems. | **6** |
| **II** | **Mathematical Modeling of Physical Systems:** Representation of physical system (Electro Mechanical) by differential equations, Determination of transfer function by block diagram reduction techniques and signal flow method, Laplace transformation function, inverse Laplace transformation. | **6** |
| **III** | **Time Response Analysis of First Order and Second Order System:** Characteristic equations, response to step, ramp and parabolic inputs, transient response analysis, steady state errors and error constants, Transient and steady state analysis of LTI systems. | **8** |
| **IV** | **Stability of the System:** Absolute stability and relative stability, Routh’s stability criterion, root locus method of analysis, polar plots, Nyquist stability criterion. M and N Loci, Nichols chart. | **8** |
| **V** | **Elementary Ideas of Compensation, Networks:** Lag, lead and log lead networks, brief idea of proportional, derivative and integral controllers. | **8** |

**References:**

1) I J Nagrath and M Gopal : Control systems Engineering, 3rd Ed, New Age Publication.

2) K AtsuhikoOgata:Modern control engineering. PRENTICE HALL OF INDIA.

**EE 304 MODERN POWER ELECTRONICS C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **AC Voltage Controllers:** Principle of On-Off Control, Principle of Phase control, Single Phase Bi-directional Controllers with Resistive Loads, Single Phase Controllers with Inductive Loads, Three Phase full wave AC controllers, AC Voltage Controller with PWM Control. | **6** |
| **II** | **Inverters:** Principle of Operation, Single-phase bridge inverters, Three phase bridge Inverters:180 and 120 degree of conduction. Voltage control of Single Phase and Three Phase Inverters, Current Source Inverters, Harmonics and its reduction techniques. | **6** |
| **III** | **Cycloconverters:** Basic principle of operation, single phase to single phase, three-phase to three-phase and three phase to single phase cycloconverters. Output equation, Control circuit. | **8** |
| **IV** | **DC Power Supplies:** Switched Mode DC Power Supplies, flyback converter, forward converter, half and full bridge converter, resonant DC power supplies, bi-directional power supplies. | **8** |
| **V** | **AC Power Supplies:** Switched mode power supplies, Resonant AC power supplies, bidirectional AC power supplies. Multistage conversions, Control Circuits: Voltage Mode Control, Current Mode Control. | **8** |

**References:**

1) M.H Rashid:Power Electronics, circuits devices and applications, PRENTICE HALL OF INDIA. ,1988.

2) V Subrahmanyam:Power electronics, New Age Inc.Publishers,New Delhi,1996

3) P.C. Sen:Power electronics Tata McGraw-Hill 1987

4) CW Lander:Power electronics,2nd edition, McGrawHill 1987

5) P.S Bimbhra:Power electronics, 2nd Ed. Khanna Publishers,1987

6) M.D.Singh and K.B. Khanchandani:Power electronics, TATA MCGRAW HILL,1998

**EE 305 TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **(i) Supply systems: -** Basic network of power system. Transmission and distribution voltage, effect of system voltage on size of conductor and losses. Comparison of DC 2- wire, DC 3- wire, 1- phase AC and 3- phase AC (3- wire and 4- wire) systems. **(ii) Distribution Systems**: - Primary and secondary distribution systems, feeder, distributor and service mains. Radial and ring- main distribution systems. Kelvin’s law for conductor size. | **6** |
| **II** | **Mechanical features of overhead lines:-**Conductor material and types of conductor. Conductor arrangements and spacing. Calculation of sag and tension supports at different levels, effect of wind and ice loading, stringing chart and sag template. Conductor vibrations and vibration dampers. | **6** |
| **III** | **Parameters of Transmission Lines:** Resistance inductance and capacitance of overhead lines, effect of earth, line transposition. Geometric mean radius and distance. Inductance and capacitance of line with symmetrical and unsymmetrical spacing Inductance and capacitance of double circuit lines. Skin and proximity effects. Equivalent circuits and performance of short and medium transmission lines**.** | **8** |
| **IV** | **(i)** Generalized ABCD line constants, equivalent circuit and performance of long transmission line. Ferranti effect. Interference with communication circuits. Power flow through a transmission line.  **(ii) Corona:** Electric stress between parallel conductors. Disruptive critical voltage and visual critical voltage, Factors affecting corona. Corona power loss. Effects of corona and calculation of losses. | **8** |
| **V** | **(i) Insulators:** Pin, shackle, suspension, post and strain insulators. Voltage distribution across an insulator string, grading and methods of improving string efficiency**. (ii) Underground Cables:** Conductor, insulator, sheathing and armoring materials. Types of cables. Insulator resistance and capacitance calculation. Electrostatic stresses and reduction of maximum stresses. Causes of breakdown. Thermal rating of cable. Introduction to oil filled and gas filled cables. | **8** |

**References:**

1) B.R.Gupta-Power system analysis and design.

2) Soni, Gupta and Bhatnagar-ACourse in Electrical Power.

3) C.L.Wadhwa-Electrical Power system.

4) Nagrath Kothari-Modern Power system Analysis.

5) J.J.Graingner and W.D.Stevenson- Power system Analysis

**EE 306 POWER SYSTEM PROTECTION C(L,T,P) = 4(3,1,0)**

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| U**NIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **(i) Causes and consequences of dangerous currents**: Faults, overloads and switching over currents. Introduction to protection, trip circuit of a circuit breaker. Functional characteristics of a relay, zone of protection, primary and backup protection. **(ii) CTs and PTs:** Current transformer construction, measurement and protective CTs. Type of potential transformers. Steady state ratio and phase angle errors in CTs and PTs. Transient errors in CT and CVT (Capacitive Voltage Transformer). | **6** |
| **II** | **Over current Protection:** HRC fuse and thermal relay. Over current (OC) relays –instantaneous, definite time, inverse time and inverse definite minimum time over current relays, time and current grading. Induction disc type relay. Directional over current relay, 30°, 60° and 90° connections. Earth fault relay. Brief description of over current protective schemes for a feeder, parallel feeders and ring mains. | **6** |
| **III** | **Generator Protection:** Stator protection – differential and percentage differential protection, protection against stator inter-turn faults, stator overheating protection. Rotor protection against excitation and prime mover failure, field earth fault and unbalanced stator currents (negative sequence current protection). | **8** |
| **IV** | **(i) Transformer Protection:** Percentage differential protection, magnetizing inrush current, percentage differential relay with harmonic restraint. Buchholz relay. Differential protection of generator transfer unit.  **(ii) Bus bar Protection:** Differential protection of bus bar, high impedance relay scheme, frames leakage protection. | **8** |
| **V** | **(i) Transmission Line Protection:** Introduction to distance protection. Construction, operating principle & characteristics of an electromagnetic impedance relay. Effect of arc resistance. Induction cup type reactance and mho relays. Comparison between impedance, reactance & mho relays. Three stepped distance protection of actual many bus system **(ii) Induction Motor Protection:** Introduction to various faults and abnormal operating conditions, unbalance supply voltage and single phasing. Introduction to protection of induction motors- HRC fuse and over current, percentage differential, earth fault and negative sequence voltage relays. | **8** |

**Reference:**

1) M Chander:Switchgear protection.2) S SRao:Switchgear and protection. 3) T M S Rao:Static Relays.4) C.L.Wadhwa-Electrical Power system.

5) J.B.GUPTA: Switchgear protection. Kataria Publications, New Delhi.

**EE 311 POWER SYSTEM INSTRUMENTS C(L,T,P) = 4(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Theory of Errors:** Accuracy and precision, systematic and random errors, limits of error, probable error and standard deviation. Gaussian error curves, combination of errors. | **6** |
| **II** | **Transducers:** Construction and Operating Characteristics of active and digital transducers, Measurement of temperature, pressure, displacement, acceleration, noise level, Instrumentation for strain, displacement, velocity, acceleration, force, torque and temperature. | **6** |
| **III** | **Signal Conditioning:** Instrumentation amplifiers, isolation amplifiers, analog multipliers, analog dividers, function generators, timers, sample and hold, optical and magnetic isolators, frequency to voltage converters, temperature to current converters. Shielding and grounding. | **8** |
| **IV** | **Power System Instrumentation-I:** Measurement of voltage, current, phase angle, frequency, active power and reactive power in power plants. Energy meters and multipart tariff meters. | **8** |
| **V** | **Power System Instrumentation-II:** Capacitive voltage transformers and their transient behavior, Current Transformers for measurement and protection, composite errors and transient response. | **8** |

**References:**

1) Electrical and Electronics measurements and measuring instruments. A.K.SAWAHNEY-DhanpatRai and Sons

2) Electrical measurements and measuring instruments by Rajendra Prasad-Khanna Publishers

**EE 308 HIGH VOLTAGE ENGINEERING C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **(i) Breakdown in Gases:** Introduction to mechanism of breakdown in gases, Townsend’s breakdown mechanism. Breakdown in electromagnetic gases. Application of gases in power system. **(ii) Breakdown in Liquids:** Introduction to mechanism of breakdown in liquids, suspended solid particle mechanism and cavity breakdown. Application of oil in power apparatus. **(iii) Breakdown in solids:** Introduction to mechanism of breakdown in solids, electromechanical breakdown, treeing and tracking breakdown and thermal breakdown. | **6** |
| **II** | **(i) High DC Voltage Generation:** Generation of high dc voltage, basic voltage multiplier circuit. **(ii) High AC Voltage Generation:** Cascaded Transformers. **(iii) Impulse Voltage generation:** Impulse voltage, basic impulse circuit, Marx’s multistage impulse generator. **(iv) Measurement of High Voltage:** Potential dividers - resistive, capacitive and mixed potential dividers. Sphere gap- Construction and operation. Klydonorgraph. | **6** |
| **III** | **Nondestructive Insulation Tests: (i)** Measurement of resistively, dielectric constant & loss factor. High Voltage Schering Bridge- measurement of capacitance & dielectric loss. **(ii) Partial Discharges:** Introduction to partial discharge, partial discharge equivalent circuit. Basic wide-band and narrow band PD detection circuits. | **8** |
| **IV** | **(i) Over voltages:** Causes of over voltages, introduction to lightning phenomena, over voltages due to lighting. **(ii) Travelling Waves:** Travelling waves on transmission lines-open end line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at a T-junction and line terminated through a capacitance. Attenuation of travelling waves. | **8** |
| **V** | **(i) Over Voltage Protection:** Basic construction and operation of ground wires- protection angle and protective zone, ground rods, counterpoise, surge absorber, rod gap and arcing horn, lighting arresters - expulsion type, non -linear gap type and metal oxide gapless type. **(ii) Insulation Coordination:** Volt - time curves, basic impulse insulation levels, coordination of insulation levels. | **8** |

**References:**

1) C.L.Wadhwa :High voltage Engineering, New Age International Publishers

2) Kamraj and Naidu :High voltage Engineering, TATA MCGRAW HILL

# EE 351 POWER ELECTRONICS LAB C(L,T,P) = 1(0,0,2)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Study the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, Diac, Triac, GTO, MOSFET, MCT and SIT. |  |
| **II** | Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents. |  |
| **III** | Find V-I characteristics of TRIAC and DIAC. |  |
| **IV** | Find output characteristics of MOSFET and IGBT. |  |
| **V** | Find transfer characteristics of MOSFET and IGBT. |  |
| **VI** | Find UJT static emitter characteristics and study the variation in peak point and valley point |  |
| **VII** | Study and test firing circuits for SCR-R, RC and UJT firing circuits. |  |
| **VIII** | Study and test 3-phase diode bridge rectifier with R and RL loads. Study the effect of filters. |  |
| **IX** | Study and obtain waveforms of single-phase half wave controlled rectifier with and without filters. Study the variation of output voltage with respect to firing angle. |  |
| **X** | Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode. |  |
| **XI** | Study and obtain waveforms of single-phase full controlled bridge converter with R and RL loads. Study and show rectification and inversion operations with and without freewheeling diode |  |
| **XII** | Control the speed of a dc motor using single-phase half controlled bridge rectifier and full controlled bridge rectifier. Plot armature voltage versus speed characteristics. |  |

# EE 352 ADVANCE CONTROL LAB C(L,T,P) = 1(0,0,2)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | 1 Introduction to MATLAB Computing Control Software. Plot bode plot for a 2nd order system and find GM and PM. |  |
| **II** | Defining Systems in TF, ZPK form |  |
| **III** | (a) Plot step response of a given TF and system in state-space. Take different values of damping ratio and naturalundamped frequency. (b) Plot ramp response |  |
| **IV** | For a given 2nd order system plot step response and obtain time response specification |  |
| **V** | To design 1st order R-C circuits and observes its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse |  |
| **VI** | To design 2nd order electrical network and study its transient response for step input and following cases. (a) Under damped system (b) Over damped System. (c) Critically damped system. |  |
| **VII** | To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies. (a) Log Network (b) Lead Network (c) Log-lead Network |  |
| **VIII** | To draw characteristics of AC servomotor |  |
| **IX** | To perform experiment on Potentiometer error detector |  |
| **X** | Check for the stability of a given closed loop system. |  |
| **XI** | Plot bode plot for a 2nd order system and find GM and PM. |  |

# EE 353 MATLAB PROGRAMMING LAB C(L,T,P) = 1(0,0,2)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs. Scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects. Multi-dimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets) |  |
| **II** | **Simulink:** Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets) |  |

# EE 354 MODERN POWER ELECTRONICS LAB C(L,T,P) = 1(0,0,2)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Study and test AC voltage regulators using triac, ant parallel thrusters and triac and diac. |  |
| **II** | 2 Study and test single phase PWM inverter |  |
| **III** | Study and test buck, boost and buck- boost regulators |  |
| **IV** | Study and test MOSFET chopper |  |
| **V** | Study and test Zero voltage switching. |  |
| **VI** | Study and test SCR DC circuit breaker |  |
| **VII** | Control speed of a dc motor using a chopper and plot armature voltage versus speed characteristic. |  |
| **VIII** | Control speed of a single-phase induction motor using single phase AC voltage regulator |  |
| **IX** | Study single-phase dual converter. (ii) Study speed control of dc motor using single-phase dual converter |  |
| **X** | Study one, two and four quadrant choppers (DC-DC converters |  |
| **XI** | Study speed control of dc motor using one, two and four quadrant choppers. |  |
| **XII** | Study single-phase cycloconverter. |  |

# EE 355 COMPUTER BASED POWER SYSTEM LABC(L,T,P) = 1(0,0,2)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | 1 Fault analysis (for 3 to 6 bus) of real power system and verify the results using MATLAB or any available software for the cases:  (i) LG Fault  (ii) LLG Fault  (iii) LL Fault and  (iv) 3-Phase Fault |  |
| **II** | Load flow analysis for a real power system (for 3 to 6 bus) using  (i) Gauss Seidal  (ii) Newton Raphson  (iii) Fast Decoupled Method and verify results using MATLAB or any available software |  |
| **III** | Study of voltage security analysis |  |
| **IV** | Study of overload security analysis and obtain results for the given problem using MATLAB or any software |  |
| **V** | Study of economic load dispatch problem with different methods |  |
| **VI** | Study of transient stability analysis using MATLAB/ETAP Software. |  |

**EE401 POWER SYSTEM ANALYSIS C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | (i) Percent and per unit quantities. Single line diagram for a balanced 3-phase system. **(ii)Admittance Model:** Branch and node admittances Equivalent admittance network and calculation of Y bus. Modification of an existing Y bus. | 6 |
| **II** | **(i) Impendence Model:** Bus admittance and impedance matrices of real power sytem. Thevenin’s theorem and Z b direct determination of Z bus. Modification of an existing bus.  **(ii) Symmetrical fault Analysis**  Transient on a Transmission line, short circuit of a synchronous machine on no load, short circuit of a loaded synchronous machine. Equivalent circuits of synchronous machine under sub transient, transient and steady state conditions. Selection of circuit breakers, Algorithm for short circuit studies. Analyses of 3 phase faults. | 8 |
| **III** | **(i) Symmetrical Components:** Fortescure theorem, symmetrical component transformation. Phase shift in star-delta transformers. Sequence Impedances of transmission lines, Synchronous Machine and Transformers, zero sequence network of transformers and transmission lines. Construction of sequence networks of power system.  **(ii) Fault Analysis:**  Analysis of single line to ground faults using symmetrical components, connection of sequence networks under the fault condition. | 8 |
| **IV** | **Unsymmetrical Fault Analysis:**  (i) Analysis of line-to-line and double line to ground faults for real power system using symmetrical components, connection of sequence networks under fault conditions.  (ii) Analysis of unsymmetrical shunt faults using bus impedance matrix method. | 8 |
| **V** | **Load Flow Analysis:** Load flow problem, development of load flow equations for real power system, bus classification. Gauss Seidel, Newton Raphson, decoupled and fast decoupled methods for load flow analysis.Comparison of load flow methods. | 6 |

**References:**1)Power System Analysis by, By Nagrath Kothari, TMH  
2) Electrical Power System By C.LWadhwa , New Age Publisher  
3) Power System Analysis by B.R Gupta,wheeler publication  
4) Power System Analysis by J.B Gupta,Katria&sons publication  
5) Power System Analysis by Bakshi&Bakshi, Technical Publication

**EE 402 ELECTRICAL DRIVES C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Dynamics of Electric Drives:** Fundamental torque equations, speed-torque conventions and multi-quardant operation, equivalent values of drive parameters, nature and classification of load torques, steady state stability, load equalization, close loop configurations of drives. | **6** |
| **II** | **DC Drives:** Speed torque curves, torque and power limitation in armature voltage and field control, Starting. **Braking-**Regenerative Braking, dynamic braking and plugging. **Speed Control-**Controlled Rectifier fed DC drives, Chopper Controlled DC drives. | **6** |
| **III** | **Induction Motor Drives-I: Starting. Braking-**Regenerative braking, plugging and dynamic braking. **Speed Control-**Stator voltage control, variable frequency control from voltage source, Voltage Source Inverter (VSI) Control. | **8** |
| **IV** | **Induction Motor Drives-II:** Variable frequency control from current source, Current Source Inverter (CSI) Control, Cycloconverter Control, Static rotor resistance control, Slip Power Recovery- Stator Scherbius drive, Static Kramer drive. | **8** |
| **V** | **Synchronous Motor Drive**: Control of Synchronous Motor-Separately Controlled and VSI fed Self-Controlled Synchronous Motor Drives. Dynamic and Regenerative Braking of Synchronous Motor with VSI. Control of Synchronous Motor Using Current Source Inverter (CSI) | **8** |

**References:**

1) G K Dubey Fundamentals of Electrical Drives,Narosa Publishing House, New Delhi,1995.

2) V Subrahmanyam:Thyristor control of electric Drives,Tata McGraw Hill, New Delhi, 1988.

3) V Subrahmanyam:Electric Drives-Concepts and Applications,Tata McGraw Hill,New Delhi.

4) S K Pillai:A first course on electrical Drives,Wiley Eastern limited,India.

5) B K Bose:Power electronics and A. C. Drives, Prentice Hall.

**EE 403 ELECTRICAL MACHINE DESIGN C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **GENERAL**: Basic principles of electrical machine design. Factors and limitations in design, Main dimensions, output equations and output co-efficient, classification of magnetic materials and allowable flux densities. Calculation of magnetic circuits, magnetizing current, coils for given ampere-turns. Real and apparent flux densities. Tapered teeth. Carter's coefficient, leakage fluxes reactance. Classification of insulation materials and their temperature ranges. | **6** |
| **II** | **ARMATURE WINDING** : General features of armature windings, single layer and double layer and commutator windings, integral and fractional slot windings, winding factors. | **6** |
| **III** | **HEATING COOLING AND VENTILATION** : Heat dissipation, heat flow, heating cooling curves. Heating cooling media. Quantity of cooling media. Types of enclosures. Ratings, heat dissipation. Methods of ventilation. | **8** |
| **IV** | Application of above design principles to the design of power transformers and distribution transformer. | **8** |
| **V** | Application of above design principles to the design of induction machines and synchronous machines. | **8** |

**Reference:**

1) A.K. Sawahney: Electrical machine design.DhanpatRai& Sons.

2) V.N. Mittle: Electrical Machine Design.

3) R.K. Agrawal-Electrical machine Design, Kataria Publications.

**EE 404 EHV AC/DC TRANSMISSION C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **EHV AC Transmission:** Need of EHV transmission lines, power handling capacity and surge impedance loading & calculation. Problems of EHV transmission, bundled conductors: geometric mean radius of bundle, properties of bundle conductors. Electrostatic fields of EHV lines and their effects, corona effects: Corona loss, audio and radio noise. | **6** |
| **II** | **Load Frequency Control:** Introduction to control of active and reactive power flow, turbine speed governing system. Speed governing characteristic of generating unit and load sharing between parallel operating generators. **Method of Load Frequency Control:** Flat frequency, flat tie line and tie line load bias control. Automatic generation control (description of block diagram only). | **6** |
| **III** | **Voltage Control:** No load receiving end voltage and reactive power generation. Methods of voltage control. Synchronous phase modifier, shunt capacitors and reactors, saturable reactors, **Thynstorised static VAR compensators-** TCR, FC-TCR and TSC- TCR. | **8** |
| **IV** | **FACTS:** Introduction to FACTS controllers, types of FACTS controllers, Brief description of STATCOM,SVC, Thyristor controlled series capacitors and unified power flow controller, Need of FACTS in wind farm. | **8** |
| **V** | **HVDC Transmission:** Types of D.C. links, advantages and disadvantages of HVDC transmission. Basic scheme and equipment of converter station. Ground return. Basic principles of DC link control and basic converter control characteristics. Application of HVDC transmission. | **8** |

**Reference:**

1) R.D. Begamudre-EHV AC Transmission Engineering.

2) K.R. Padiyar-HVDC Power Transmission System

3) J.J. Grainger and W.D. Stevenson-Power system analysis.

4) B.R. Gupta-Generation of Electrical Engineering.

**EE 405 UTILIZATION OF ELECTRIC POWER AND TRACTION C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **(i) Electric Heating:** Different methods of electric heating. Principle of high frequency induction and di-electric heating. Construction, operation, performance and applications of arc furnace and induction furnace. **(ii) Electric Welding:** Welding process, welding transformer, Classification of Electric Welding: arc welding, resistance welding, welding of various metals. | **6** |
| **II** | **Illuminations:** Definitions, laws of illuminations, polar curves, luminous efficiency, photometer, incandescent lamps: filament materials, halogen lamp. Electric discharge lamps: sodium vapour lamp mercury vapour lamp and fluorescent lamp. **Light Calculations:** Commercial, industrial, street and flood lighting. | **6** |
| **III** | **Electrolytic Process:** Principles and applications of electrolysis, electro-deposition, manufactures of chemicals, anodizing, electro polishing electro-cleaning, electroextraction, electro refining, electro-stripping (parting) power supplies for electrolytic process. | **8** |
| **IV** | **Electric Traction and Means of Supplying Power:** Systems of Electric Traction: DC and AC Systems, Power Supply for Electric Traction System: Comparison and application of different systems. Sub-station equipment and layout, conductor rail and pantograph. | **8** |
| **V** | **Traction Methods:** Types of services, speed time and speed distance curves, estimation of power and energy requirements, Mechanics of train movement. Co-efficient of adhesion, Adhesive weight, effective weight. **Traction Motor Controls:** DC and AC traction motors, Series parallel starting. Methods of electric braking of traction motors. | **8** |

**Reference:**

1) H Pratap-Art and Science of Utilization of Electric Power

2) H. Pratap-Modern Electric Traction.

3) C.L. Wadhwa-Utilization of electric traction electric power.

4) G.K. Dubey-Electric Drives. Narosa Publishing House.

5) Vedam and Subrahmanyam-Concept and Application of Electric Drives.

**EE 406 SWITCHGEAR & PROTECTION C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **(i) Static Relays:** Introduction to static relays, merits and demerits. **Comparators:** amplitude and phase comparators, duality between amplitude and phase comparators. Introduction to  (a) amplitude comparators-circulating current type, phase splitting type and sampling type,  (b) phase comparators-vector product type and coincidence type.  **(ii) Static over Current Relays:** Introduction to instantaneous, definite time, inverse time and directional over current relays. | **6** |
| **II** | **(i) Static Differential Relays:** Brief description of static differential relay schemes – single phase and three phase schemes. Introduction to static differential protection of generator and transformer.  **(ii) Static Distance Relays:** Introduction to static impedance, reactance and mho relays. | **6** |
| **III** | **(i) Carrier Current Protection:** Basic apparatus and scheme of power line carrier system. Principle of operation of directional comparison and phase comparison carrier protection and carrier assisted distance protection.  **(ii) Distance Protection:** Effect of power swings on the performance of distance protection. Out of step tripping and blocking relays, mho relay with blinders. Introduction to quadrilateral and elliptical relays. | **8** |
| **IV** | **Circuit Breakers I:** Electric arc and its characteristics, arc interruption-high resistance interruption and current zero interruption. Arc interruption theories–recovery rate theory and energy balance theory. Re-striking voltage and recovery voltage, develop expressions for re-striking voltage and RRRV. Resistance switching, current chopping and interruption of capacitive current. Oil circuit breakers-bulk oil and minimum oil circuit breakers. Air circuit breakers. | **8** |
| **V** | **(i) Circuit Breakers II:** Air blast, SF6 and vacuum circuit breakers. Selection of circuit  breakers, rating of circuit breakers.  **(ii) Digital Protection:** Introduction to digital protection. Brief description of block diagram  of digital relay. Introduction to digital overcurrent, transformer differential and transmission  line distance protection. | **8** |

**References:**

1. Switch Gear Protection by J.B. Gupta, Katria& Sons Publishers

2. Switch Gear Protection by B.Ram, TMH.

3. Switch Gear Protection by S.S Rao, TMH

**EC 407 ELECTROMAGNETIC FIELD THEORY C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction:** Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green’s, Stoke’s and Helmholz theorems. | **6** |
| **II** | **Electrostatics:** Electric field vectors-electric field intensity, flux density and polarization. Electric field due to various charge configurations. The potential functions and displacement vector. Gauss’s law. Poisson’s and Laplace’s equation and their solution. Uniqueness theorem.Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field mappings and concept of field cells. | **6** |
| **III** | **Magnetostatics:** Magnetic field vector: Magnetic field intensity, flux density and magnetization, Bio-Savart’s law, Ampere’s law, Magnetic scalar and vector potential, self and mutual inductance, Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cells. | **8** |
| **IV** | **Time Varying Fields:** Faraday’s law, Displacement currents and equation of continuity.Maxwell’s equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflections, refraction and polarization of UPW, standing wave ratio.Pointing vector and power considerations. | **8** |
| **V** | **Transmission Lines:** The high-frequency circuit. LCR ladder model. The transmission line equation. Solution for loss-less lines. Wave velocity and wave impedance. Reflection and Transmission coefficients at junctions. VSWR. | **8** |

**Reference:**

1) David K Cheng-Field and Wave Electromagnetic 2nd Ed. Wesley Publishing company.

2) Griffith-Introduction to Electrodynamics. 2nd Ed., Prentice Hall of India.

3) J D Kraus, Electromagnetic. 5th, McGraw Hill Book company.

4) P Lorrain, D R Corson-Electromagnetic field and waves. Willey Eastern Ltd.

5) V.V. Sarwate-Electromagnetic field and waves, willeyestern Ltd.

6) The Feynman Lectures on physics, Vol-II Narosa Publishing House.

7) J.K. Kraus-Applied Electromagnetic, 5th Ed.

**EE408 POWER SYSTEM ENGINEERING C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Economic Operation of Power Systems:** Introduction, system constraints, optimal operation of power systems. Input output, heat rate and incremental rate curves of thermal generating units. Economic distribution of load between generating units within a plant. Economic distribution of load between power stations, transmission loss equation. Introduction to unit commitment and dynamic programming. | **6** |
| **II** | **Power System Stability -I:** Power angle equations and power angle curves under steady state, and transient conditions. Rotor dynamics and swing equation (solution of swing equation not included), synchronizing power coefficient. Introduction to steady state and dynamic stabilities, steady state stability limit. | **6** |
| **III** | **Power System Stability-II:** Introduction to transient stability. Equal area criterion and its application to transient stability studies under basic disturbances, critical clearing angle and critical clearing time. Factors affect stability and methods to improve stability. | **8** |
| **IV** | **(i) Excitation Systems:** Introduction of excitation systems of synchronous machines, types of excitation systems, Elements of various excitation systems and their control (functional block diagrams and their brief description)-DC excitation systems, AC excitation systems, brushless excitation system.  **(ii) Interconnected Power Systems:** Introduction to isolated and interconnected powers systems. Reserve capacity of power stations, spinning and maintenance reserve. Advantages and problems of interconnected power systems. Power systems inter connections in India. | **8** |
| **V** | (i) Tap Changing transformer, phase angle control and phase shifting transformer. Series compensation of transmission lines, location and protection of series capacitors, advantages and problems. (ii) Introduction to power system security. (iii) Introduction to voltage stability. | **8** |

**Referemce:**1)Electrical Power System By C.LWadhwa , New Age Publisher **2)**Power System Engineering By Nagrath Kothari, TMH **3)**Power System Engineering By C.M Arora,  **4)**Power System Engineering by B.R Gupta,wheeler publication

**EE 409 DISTRIBUTION OF ELECTRICAL POWER C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **(i) Distribution Systems:** Distribution of power, future distribution systems, power loads.  **(ii) Load Forecasting:** Introduction, load survey, load forecasting-regression analysis, correlation theory, analysis of time series, load growth factors, sources of error. | **6** |
| **II** | **Operation:** Operation criterion and standards: Voltage control – voltage regulation, kVA – km conductor loading, correction of system voltage. Harmonics – introduction, effects of harmonics on networks, limits of harmonics, filters.  **Load variations**- causes of voltage fluctuations, measures to reduce flickering. Ferro resonance. System losses - introduction, losses in components, measurement of losses, reduction of losses. Energy management. | **6** |
| **III** | **Distribution Power Capacitors:** Reactive power flow, monitoring and compensation in distribution system, maintaining system voltage. Series and shunt capacitors, comparison. Shunt capacitors in distribution system - LT and HT shunt capacitors, capacitor rating for power factor improvement, constructional features. System harmonics. | **8** |
| **IV** | **Grounding:** Grounding system, earth and safety, earth electrode- earth resistance calculation, effect of rod size and soil resistivity, earth conductor sizes. Introduction to earth electrode design. Brief description of system earthing – system neutral earthing, earthing of substations, lines and consumer premises. Earth fault protection of feeders. | **8** |
| **V** | Distribution Automation: Introduction to distribution automation. Concept of communication-power line carrier, radio communication, fiber optics, satellite communication and sensors.Introduction to supervisory control and data acquisition (SCADA).Brief descriptor of an automation system. | **8** |

**References:**

1) B.R.Gupta-Power system analysis and design  
2) Soni, Gupta and Bhatnagar-ACourse in Electrical Power  
3) C.L.Wadhwa-Electrical Power system.

4) Nagrath Kothari-Modern Power system Analysis  
5) J.J.Graingner and W.D.Stevenson- Power system Analysis

**EE-410 ELECTRICAL ENGINEERING MATERIALS** C(L,T,P) = 3(3,0,0)

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Dielectric Materials:**  Static dielectric constant, Polarization, atomic interpretation of the dielectric constant of mono-atomic and poly atomic gases, internal fields in the solids and liquids, static dielectric constants of solids, ferroelectric materials and spontaneous polarization, piezo- electricity. Frequency dependence of electronics, ionic and orientational polarization, complex dielectric constant and dielectric losses. | **6** |
| **II** | **Conductivity of Metals:**  Ohm's Law and relaxation time of electrons, collision time and mean free path. Electron scattering, and resistivity of metals. Heat developed in current carrying conductor, thermal conductivity of metals, and superconductivity. | **6** |
| **III** | **Magnetic Materials:**  Magnetisation from microscopic view point, orbital magnetic dipole movement and angular momentum materials. Diamagnetism, origin of permanent magnetic dipoles in material, and paramagnetic spin systems. | **8** |
| **IV** | **Properties of ferromagnetic materials:**  Spontaneous magnetization and the curie-Weils Law. Ferromagnetic Domains and coercive force, anti-ferromagnetic and ferromagnetic materials. Magnetic materials for electrical devices, and introduction to permanent magnets. | **8** |
| **V** | **Mechanism of Conduction in semiconductor materials:**  Types of semiconductors, current carriers in semiconductors, Half effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET, properties of semiconducting materials. | **8** |

**References:**

1. Electrical Engineering materials by A.J. Dekker.

2. Electrical Engineering Materials by G.P. Chhalotra.

3. Electrical Engineering materials by S.P. Seth and P.V. Gupta.

4. Electrical Engineering materials by J.B. Gupta.

**EE 411 POWER SYSTEM RELIABILITY C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **SYSTEM RELIABILITY**: Introduction, definition of reliability, failure, probability, concepts, power quality variation, reliability measurements, power supply quality survey, Reliability aids, and recent development. | **6** |
| **II** | **RELIABILITY CONCEPTS**: Measure of reliability rules for combining probabilities, Mathematical expectation. Distributions, reliability theory series and parallel systems, Markov processes. Static generating capacity reliability. | **6** |
| **III** | **OUTAGE DEFINITION**: Loss of load probability methods, loss of energy probability method. Load forecast, System Design and planning, Strategies for generation, Transmission and Distribution networks. Transmission system reliability evaluation-Average interruption rate method. The frequency and duration method. | **8** |
| **IV** | **INTERCONNECTED SYSTEM**: Generating capacity reliability evaluation introduction. The loss of load approach, reliability evaluation in two and more than two interconnected systems, Interconnection benefits. | **8** |
| **V** | **LOAD FORECASTING**: Necessity short-term forecasting by preliminary analysis control, medium term forecasting by field survey method, and long-time forecasting by statistical method. Regression analysis. Analysis of time series. Factors in power system loading. | **8** |

**Reference:**

1) Roy Billinton and Ronald N.Allan-Reliability Evaluation of power system volume-I

2) Roy Billinton and Ronald N.Allan-Reliability evaluation of power System volume-II

3) J Endreny-Reliability modelling in electric power system.

4) A.S. Pabla-Electric power distribution.

**EE 454 MATLAB SIMULATION LAB C(L,T,P) = 1(0,0,2)**

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Simulate Swing Equation in Simulink (MATLAB) |  |
| **II** | Modelling of Synchronous Machine |  |
| **III** | Modelling of Induction Machine |  |
| **IV** | Simulate simple circuits using Circuit Maker. |  |
| **V** | (a) Modelling of Synchronous Machine with PSS (b) Simulation of Synchronous Machine with FACTS device. |  |
| **VI** | (a) Modelling of Synchronous Machine with FACTS device (b) Simulation of Synchronous Machine with FACTS devices. |  |
| **VII** | FACTS Controller designs with FACT devices for SMIB system |  |

**EE 456 Electrical Drives and control Lab C(L,T,P) = 1(0,0,2)**

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Study and test the firing circuit of three phase half controlled bridge converter. |  |
| **II** | Study and obtain waveforms of 3 phase half controlled bridge converter with R and RL loads. |  |
| **III** | Study and test the firing circuit of 3-phase full controlled bridge converter. |  |
| **IV** | Study and obtain waveforms of 3-phase full controlled bridge converter with R and RL loads. |  |
| **V** | Study and test 3-phase AC voltage regulator |  |
| **VI** | Control speed of dc motor using 3-phase half controlled bridge converter. Plot armature voltage versus speed characteristic |  |
| **VII** | Control speed of dc motor using 3-phase full controlled bridge converter. Plot armature voltage versus speed characteristic |  |
| **VIII** | Control speed of a 3-phase induction motor in variable stator voltage mode using 3-phase AC voltage regulator |  |
| **IX** | Control speed of universal motor using AC voltage regulator. |  |
| **X** | Study 3-phase dual converter. |  |
| **XI** | Study speed control of dc motor using 3-phase dual converter. |  |
| **XII** | Study three-phase cycloconverter and speed control of synchronous motor using cycloconverter |  |
| **XIII** | Control of 3-Phase Induction Motor in variable frequency V/f constant mode using 3-phase inverter. |  |

# EE 457 ELECTRICAL CIRCUIT LAB C(L,T,P) = 1(0,0,1)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | DC-analyze resistor networks to determine node voltages, components voltages, and component currents. |  |
| **II** | Analyze resistor networks that have several voltage and current sources and variable load resistors. |  |
| **III** | Transient –analyze RC & RL circuits to produce tables of component voltage & current levels for a given set of time instants & to produce graphs of voltages & currents versus time |  |
| **IV** | AC-analyze impedance networks to determine the magnitude & phase of node voltages,  components voltages and component currents. |  |
| **V** | Determine the magnitude & phase and component voltages and currents in resonant circuits & produce voltage and current v/s frequency graphs. |  |
|  | **Programs For Circuit Analysis** |  |
| **VI** | To determine line and load currents in a 3phase delta connected load system connected to a 3 phase balanced ac supply |  |
| **VII** | To obtain a transient response in a single phase full wave rectifier with a filter capacitor. |  |

**EE 458 HIGH VOLTAGE ENGINEERING LAB C (L,T,P) = 1(0,0,2)**

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Study filtration and Treatment of transformer oil. |  |
| **II** | Determine dielectric strength of transformer oil |  |
| **III** | Determine capacitance and dielectric loss of an insulating material using Schering bridge. |  |
| **IV** | Study solid dielectrics used in power apparatus. |  |
| **V** | Study applications of insulating materials. |  |
| **VI** | Study direct testing and indirect testing of circuit breakers. |  |
| **VII** | Study high voltage testing of electrical equipment: line insulator, cable, bushing, power capacitor, and power transformer |  |
| **VIII** | Design an EHV transmission line. |  |

**EE 501 POWER SYSTEM ANALYSIS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Fault Analysis:** Positive. Negative and Zero Sequence equivalent circuits of lines, two and three winding transformers, induction machines and synchronous machines. Analysis of shunt and series faults, effect of neutral grounding. | **6** |
| **II** | **Unbalanced Operation of 3-phase Induction Motors:** Characteristics with application of unbalanced voltage to a balanced motor and with application of balanced voltage to a motor having unbalanced impedances in the rotor circuit. | **6** |
| **III** | **Synchronous Machines:** Short circuit currents and reactances of synchronous machine. Modelling of synchronous machine at no load and symmetrical load under steady state conditions, Sequence impedance of synchronous machines. | **8** |
| **IV** | **Linear Graph Theory:** Study of linear graph theory, Network topology, incidence, Cut-set and Tie-set matrices and their interpretation. Calculation of Z-bus, Y-bus, Z-branch and Y loop matrices by singular and non-singular transformations. Algorithm for the calculation of Y-bus and Z-bus. Fault calculations using Z-bus. | **8** |
| **V** | **Load Flow Studies:** Formulation of load flow problem. Various types of buses. Gause- Siedel, Newton-Raphson and Fast Decoupled Algorithms. Calculation of reactive power at voltage controlled buses in the Gauses-Seidel iterative method using Y-bus, Representation of transformers - Fixed tap setting transformer, Tap changing under load transformers, Phase shifting transformers, Tie line control, Comparison of methods for load flow. | **8** |

# Reference:

1) J.J. Grainger,William, D.StevensonJr Power system Analysis.

2) C L Wadhwa, Electrical power system.New Age international publishers.

3) B.R.Gupta: Power system Analysis and Design.

**EE 502 POWER SYSTEM STABILITY C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Modeling of synchronous machines:**Modeling of cylindrical rotor salient pole synchronous machines, flux linkage equations, voltage equations, Park's transformation, various inductances and time constraints of synchronous machines, vector diagrams for steady state and transient conditions, power angle curves. | **6** |
| **II** | **Stabilities:** Steady state and transient stabilities, their definitions and methods of determination. Development of Swing equation. | **6** |
| **III** | **Machine Systems:** Steady state stability of single machine connected to an infinite bus by the method of small oscillations. Two machine systems. Coherent and non-coherent machines. | **8** |
| **IV** | S**tudy of various stability methods:** Equal area criterion of determining transient stability, fault clearing time and critical clearing angle. Solution of Swing equation by step by step method. Euler's Method and Runga-Kutta Method, Application of Computers in the study of transient stability using these methods. Introduction to steady state and transient Stability using these methods. Introduction to steady state and transient stabilities of multi-machine system without controller. | **8** |
| **V** | **Factors affecting Stabilities:** Factors affecting steady state and transient stabilities, methods of improving steady state and transient stabilities, high speed circuit breakers, auto-reclosing circuit breaker, single pole operation, excitation control, and bypass valving. | **8** |

**References:**

1) C L Wadhwa, Electrical power system.New Age international publishers.

2) B.R.Gupta: Power system Analysis and Design.

**EE 504 HVDC TRANSMISSION C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Thyristor Valve:** Thyristor device, Steady state and switching characteristics, Light activated power thyristor, LED, fiber optics, valve firing, parallel and series connections of thyristors. | **6** |
| **II** | **Converter Circuits:** Rectification and inversion, affect of reactance, six pulse and twelve pulse converter circuits. | **6** |
| **III** | **DC Link Control:** Principles of DC link control, Converter control characteristics, System control hierarchy, Firing angle control, Extinction angle control, starting, stopping and power flow reversal of DC link, Power control, and Parallel operation of DC link with AC transmission line. Converter faults, commutation failure, valve blocking and bypassing. Protection against over currents, over voltages. DC circuit breakers. Reactive Power Control: Reactive power requirement in steady state, Sources of reactive power and reactive power control. | **8** |
| **IV** | **(i) Harmonic and Filters:** Generation of harmonics, AC and DC side harmonics, Characteristics and non-characteristics harmonics. Types of AC filters – single tuned and double tuned filters, high pass filter, DC Smoothing reactor and filters. (ii) Scheme of a HVDC converter station and components of HVDC transmission system. | **8** |
| **V** | **Multi Terminal DC (MTDC) Systems:** Types of MTDC systems, Comparison of series and parallel MTDC systems, Control and protection of MTDC systems, Application of MTDC systems. | **8** |

**References:**

1. K.R. Padiyar-HVDC Power Transmission System.
2. Power System Engineering by C.M.Arora.

**EE 506 POWER SYSTEM TRANSIENTS AND PROTECTION C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | Wave terminology, development of wave equations, terminal problems, lattice diagrams. Origin and nature of power system surges, wave shapes, attenuation, effect of shielding by ground wires and masts, tower footing-resistance. Traveling waves, multi-velocity waves, methods of measuring tower footing resistance, voltages across insulator strings. Dynamic over voltages during surges and system faults, system recovery voltage characteristics. | **6** |
| **II** | **Neutral Grounding:** Methods of neutral grounding and their effect on system behaviour. Insulation coordination, requirement in surge protection of lines and equipment. | **6** |
| **III** | **Static Relays:** Introduction, advantages of static relays over electromagnetic relays. Limitation of static relays, Reliability and Security of static relays, Recent Developments of static relays. | **8** |
| **IV** | **Comparators:** Comparators and Level Detectors: Static Relay Functional circuits, Amplitude and Phase comparators, level detectors. Digital Relays, Microprocessor based protective relays. | **8** |
| **V** | **Switchgear:** Types of circuit breakers and their constructional features, operating mechanism Application of Circuit breakers, speed of circuit breakers, Auto reclosing, selection of circuit breakers, Rating of circuit breakers, Testing of circuit breakers, SF6 Insulated Metal clad Switchgear (CIS), Advantages, Demerits, Design aspects, Busbar modules, SF6 , Insulated EHV Transmission Cables (GIC). | **8** |

**References:**

1) M Chander : Switchgear protection.

2) S SRao: Switchgear and protection.

3) T M S Rao: Static Relays.

4) C.L.Wadhwa-Electrical Power system.

5) J.B.GUPTA: Switchgear protection. Kataria Publications, New Delhi.

6) Kamraj and Naidu: High voltage Engineering, TATA MCGRAW HILL

**EE 508 ADVANCED POWER SYSTEM C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Voltage Stability:** Power system voltage stability concept, comparison of angle and voltage stabilities, Power system loads, generator P-Q and Q-V characteristics. Voltage collapse. Voltage stability analysis. Methods of improving voltage stability. | **6** |
| **II** | **Distribution Automation:** Introduction to distribution automation. Concepts of communication - power line carrier, radio communication, fibre optics, satellite Communication and sensors. Introduction to supervisory control and data acquisition (SCADA). Brief description of an automation system. | **6** |
| **III** | **FACTS:** Problem of AC transmission systems, basic principle of power flow control of an AC transmission line. Basic types of FACTS controllers. Brief description of FACTS controllers- STATCOM, Static Voltage and phase angle regulators, thyristor switched and thyristor controlled series capacitors, Unified Power Flow Controller. | **8** |
| **IV** | **Energy Conservation:** Introduction, conservation of natural resources, principles of energy conservation and energy audit. Brief description of energy conservation in power plants, electric utilities, electric drives, industries and electric lighting. | **8** |
| **V** | **Superconductivity:** Basic characteristics of superconductors. Brief description of applications of superconductivity to electric power systems - superconducting generators, motors, transformers, transmission cables and magnetic storage. | **8** |

**References:**

1) C L Wadhwa, Electrical power system.New Age international publishers.

2) B.R.Gupta: Power system Analysis and Design.

**EE 503 ADVANCED POWER ELECTRONICS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36.** |
| **I** | **Phase Controlled Converters:** Performance measures of single and three-phase converters with discontinuous load current for R, RL and RLE loads. Effect of source inductance for single and three-phase converters | **6** |
| **II** | **Chopper-**Review of choppers configurations, Steady state analysis of type A Chopper- Minimum and Maximum Currents, Ripple and average load current. Commutation in Chopper Circuits. | **6** |
| **III** | **Inverters:** Performance parameters, voltage control of three phase inverters-Sinusoidal PWM, Third Harmonic PWM, 60 degree PWM and Space Vector Modulation. Harmonic reductions | **8** |
| **IV** | **AC Voltage Controllers:** Single and Three Phase AC Controllers. AC Voltage Controller with PWM Control. | **8** |
| **V** | **Cyclo-converters:** Single phase and three phase Cyclo-converters. Reduction in Output Harmonics. Matrix Converter | **8** |

**References:**

1) C L Wadhwa, Electrical power system.New Age international publishers.

2) B.R.Gupta: Power system Analysis and Design.

**EE 510 ADVANCED CIRCUIT ANALYSIS AND DESIGN C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Network Topology:** Network geometry, incidence matrix, tie-set matrix and loop currents, cut-set matrix, and node pair potentials. Properties of cut-set and tie-set matrices, f–cutset Analysis, f-circuit Analysis, Node-pair Analysis. Duality, planner and non-planner networks. Branch parameters matrices. Kirchhoff's equilibrium equations on loop basic. Equilibrium equations on the node basis. | **6** |
| **II** | **Network Functions:** Network functions, evaluation of network function from (1) a given magnitude (2) a given angle and (3) a given real part; integral relationship between real and imaginary parts. | **6** |
| **III** | **Elements of Reliability:** Driving point functions, Brune's positive real functions, properties of positive real functions. Testing driving point functions An application of the maximum modulus theorem, properties of hurwitz polynomials, the computation of residues, even & odd functions, Sturm's theorem, An alternative test for positive real character. Driving point synthesis with LC elements: Elementary synthesis operations, LC Network Synthesis. **RC and RL Networks:** Properties of RC network functions, foster form of RC networks, foster form of RL networks. The caur form of RC and RL networks, RLC one Terminal-Pairs: Minimum positive real functions. Brune’s method of RLC synthesis. | **8** |
| **IV** | **Attenuators and Equalizers:** Symmetrical Bridge-Tand lattice attenuators, asymmetrical T and π attenuators. Equalizer configuration, four terminal equalizers, full -series, shunt and bridge-T and lattice equalizers. | **8** |
| **V** | **Active RC filters and Computer Application:** Introduction to active RC filters Realisable approximation to Ideal filter, constant time delay & Thompson filter, frequency transformation, Active RC filter, Multi amplifier Biquad realization. Fixed capacitor filter. **Computer Application:** Network solution by matrix Inversion- Gauss Elimination Method, Computer Programme for plotting transient response, Computer Programme for finding roots of polynomial equations. | **8** |

**References:**

1. D. Roy Choudhary, ‘Networks and Systems’ W. H. Hayt and J. E. Kemmerly, Engineering circuit Analysis, TMH.
2. A Chakrabarti and S. Bhadra, ‘Networks and Systems’ DhanpatRai and Co.M.E. Van Valkenberg, ‘Network Analysis’ Prentice Hall

# EE 551 MATLAB PROGRAMMING LAB C(L,T,P) = 1(0,0,2)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs.36** |
| **I** | Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs. Scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects.Multi-dimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets) |  |
| **II** | **Simulink:** Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets) |  |

**EE 552 POWER SYSTEM MODELLING & SIMULATION LAB C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **LIST OF EXPERIMENTS** |
| **I** | Simulate Swing Equation in Simulink (MATLAB) |
| **II** | Modelling of Synchronous Machine .Modelling of Induction Machine. |
| **III** | Simulate simple circuits using Circuit Maker |
| **IV** | (a) Modelling of Synchronous Machine with PSS (b) Simulation of Synchronous Machine with FACTS device.  (b) Modelling of Synchronous Machine with FACTS device (b) Simulation of Synchronous Machine with FACTS devices. |
| **V** | FACTS Controller designs with FACT devices for SMIB system. |

**EE 601 Power System Planning AND Reliability C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Load forecasting:** Classification and characteristics of loads. Approaches to load forecasting. Forecasting methodology. Energy forecasting. | **6** |
| **II** | **Basic Reliability Concepts:** General reliability function, Markov Chains and processes and their applications, simple series and parallel system models. | **6** |
| **III** | **Static Generating Capacity Reliability Evaluation:** Outage definitions, loss of load probability methods, loss of energy probability method. Frequency and duration methods, load forecasting uncertainty. | **8** |
| **IV** | **Spinning Generating Capacity Reliability Evaluation:** Spinning capacity evaluation, load forecast uncertainty. | **8** |
| **V** | **Transmission System Reliability Evaluation:** Average interruption rate method. The frequency and duration method. Stormy and normal weather effects. Inter-connected Systems Generating Capacity Reliability Evaluation: Introduction, The loss of toad approach. Reliability evaluation in two and more than two interconnected systems. Interconnection benefits. | **8** |

**Reference:**

1) Roy Billinton and Ronald N.Allan-Reliability Evaluation of power system volume-I

2) Roy Billinton and Ronald N.Allan-Reliability evaluation of power System volume-II

3) J Endreny-Reliability modelling in electric power system.

4) A.S. Pabla-Electric power distribution.

**EE 603 OPERATION & CONTROL OF POWER SYSTEMS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36.** |
| **I** | **Optimal Power System Operation:** System constraints. Generator operating cost. Input- Output and incremental fuel characteristics of a generating unit. Optimal operation of generators on a bus bar, algorithm and flow chart. Optimal unit commitment, constraints in unit commitment, spinning reserve, thermal and hydro constraints. | **6** |
| **II** | **Unit Commitment Solution Methods:** Priority list method and dynamic programming method. Reliability consideration, Patton’s security function, security constrained optional unit commitment, start- up considerations | **6** |
| **III** | **Optimal Generation Scheduling:** Development of transmission loss and incremental loss equations. Optimal generation scheduling including transmission losses, algorithm and flow chart. Optimal load flow solution. Hydrothermal coordination | **8** |
| **IV** | **Load Frequency Control:** Control of real and reactive power of generator. Turbine speed governing system, Modelling of speed governing system. Methods of frequency control: flat frequency, flat tie line and tie line load bias control. Block diagram representation of load frequency control of an isolated system, steady state analysis, dynamic response. Introduction to Two – area load frequency control | **8** |
| **V** | **(i) Power System Security**: Introduction to power system security, System monitoring, contingency analysis, System state classification, security control. **(ii) Automatic Generation Control:** Speed governing characteristic of a generating unit. Load sharing between parallel operating generators. Introduction to automatic generation control of an area by computer (description of block diagram) | **8** |

**References:**

1. S. Sivanagaraju, G. Sreenivasan, “Power System Operation and Control”1st edition, Pearson Publication, 2010
2. D.P. Kothari, I.J. Nagrath, “Modern Power System Analysis”4th Edition, Tata McGraw Hill, 2011
3. C.L. Wadhwa “Electrical Power Systems”, 6th Edition, New Age International, 2012

**EE 605 ADVANCE THEORY AND ANALYSIS OF AC MACHINES C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36.** |
| **I** | **Introduction:** Physical model, Different reference frame, Transformations, Primitive Machine, Dynamic variable, Formulation of dynamic equations of a generalized machine. | **6** |
| **II** | **Maxwell equations:** Introduction to Maxwell equations**,** Electric field of Transformers, Shaft voltages and fluxes, bearing currents. | **6** |
| **III** | **Induction machines:** Induction motor modeling, oscillations In Induction machines, Asymmetries in stator and rotor windings. | **8** |
| **IV** | **Synchronous machine:** Asynchronous-synchronous Operation of synchronous machine; Modeling, Operational Impedances, Time constants, Stability, Power angle characteristics. | **8** |
| **V** | **Short circuit analysis:** Symmetrical and Asymmetrical short circuit analysis, Measurement of Reactance, Power Systems. | **8** |

**References:**

1) P.S Bimbhra, Generalised Theory of Electrical Machines, Khanna Publishers.

2) A.E Fitzgerald, Charles Kingsley, Jr. and S D Umans, Electrical Machinery, 4th Ed., MGH Publishers.

3) C.V Jones Unified Theory of Electrical Machines, Butterworths, London 1967.

**EE 607 Excitation of synchronous machines and their control C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Excitation Systems:** Principal Controls of a generating unit. Arrangement of excitation components, voltage response-ratio. Excitation specifications. Ceiling voltage, time constant and response of excitation systems. Requirements of excitation systems: Classification of excitation systems. | **6** |
| **II** | **D.C. Excitation Systems:** configuration of DC excitation system with main and pilot exciters. Amplidyne and magnetic amplifier. Automatic voltage regulator with magnetic amplifier and Amplidyne. Limitation and problems of DC excitation systems. Improvement in DC excitation system. | **6** |
| **III** | **AC Shunt Excitation Systems (Static Rectifier Excitation Systems):** Static thyristor rectifier schemes. Transient Response during fault condition. Use of booster transformer. Application for shunt excitation systems. | **8** |
| **IV** | **AC Separately Excitation Systems. (Alternator- Rectifier Excitation System):** Scheme of alternator-rectifier excitation system with (i) diode rectifier and (ii) thyristor rectifier. Comparison and Application of these schemes. Harmful effects of static excitation systems or system machine components, means of prevention. **Brushless Excitation Systems:** Brush-slip ring problem. Scheme of Brushless excitation system with rotating diode. Control, protection and monitoring of Brushless excitation system. Introduction to brushless excitation system with rotating thyristors. Introduction to Superconducting Exciter. | **8** |
| **V** | **Automatic Voltage Regulator (AVR) AND Excitation Control:** Solid state automatic voltage regulator scheme. Auto and manual follow-up. Thyristor converter and AVR protection. Introduction to Digital AVR. **Excitation Control:** Introduction to power stabilizing signal-speed, frequency and power signals. Rotor current limiter, MVAR limiter. Effect of excitation on generator power limits, Dynamic and Transient stabilities. | **8** |

**References:**

1. A E Fitzgerald. Charles Kingsley, Jr. and S D Umans, Electrical Machinery, 4th Ed., MGH Publishers.
2. C V Jones Unified Theory of Electrical Machines, Butterworths, London 1967

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| **EE 608 RESTRUCTURED POWER SYSTEM C(L,T,P) = 3(3,0,0)**   |  |  |  | | --- | --- | --- | | **UNIT** | **COURSE CONTENTS** | **Hrs. 36** | | **I** | **Introduction:** Introduction to restructuring of power industry, issues involved in deregulation, objectives of deregulation of various power systems across the world Fundamentals of Economics. Consumer behavior, Supplier behavior, Market equilibrium, Various costs of production, . Perfectly competitive market | **6** | | **II** | **The Philosophy of Market Models**. Comparison of various market models, Electricity vis-à-vis other commodities, Congestion Management, Ancillary Services, Market architecture, **Transmission Congestion Management**. Classification, Calculation of ATC, ATC calculation using PTDF and LODF based on DC model | **6** | | **III** | **Locational Marginal Prices (LMP) and Financial Transmission Rights (FTR**). Mathematical preliminaries   Convexity, Duality, Perturbation analysis, Sensitivity analysis, KKT necessary conditions for optimality LMP, Lossless DCOPF model for LMP calculation Loss compensated DCOPF model for LMP calculation  Accuracy comparison of both the models Introduction to Financial Transmission Rights, Risk Hedging Functionality Of financial Transmission Rights | **5** | | **IV** | **Ancillary Service Management**: Types of ancillary services, Load-generation balancing related services Issues in reactive power management, Black start capability service | **4** | | **V** | **Pricing of transmission network usage and loss allocation**. Postage stamp method, Incremental postage stamp method, Contract path method, MW-Mile method, Power flow tracing Proportionate sharing principle, Graph theoretic approach  Simultaneous equations approach, Merits and de-merits of different paradigms, Introduction to loss allocation Classification of loss allocation methods, Pro-rata methods   Incremental methods, Power flow tracing based allocation Comparison between various methods | **5** | |
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**References:**

1 Fundamentals of Power System economics Daniel Kirschen and Goran Strbac, John Wiley & Sons Ltd, 2004.

2 Making competition work in electricity Sally Hunt, John Wiley & Sons, Inc., 2002.

3 Operation of restructured power systems Kankar Bhattacharya, Jaap E. Daadler,  Math H.J Bollen, Kluwer Academic Pub., 2001.

# EE 651 COMPUTER BASED POWER SYSTEM DESIGN LAB C(L,T,P) = 1(0,0,3)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | 1 Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases:  (i) LG Fault  (ii) LLG Fault  (iii) LL Fault and  (iv) 3-Phase Fault |  |
| **II** | Load flow analysis for a given system (for 3 to 6 bus) using  (i) Gauss Seidal  (ii) Newton Raphson  (iii) Fast Decoupled Method and verify results using MATLAB or any available software |  |
| **III** | Study of voltage security analysis |  |
| **IV** | Study of overload security analysis and obtain results for the given problem using MATLAB or any software |  |
| **V** | Study of economic load dispatch problem with different methods |  |
| **VI** | Study of transient stability analysis using MATLAB/ETAP Software. |  |

**CP 262 Computer Programming Lab C(L,T,P) = 1(0,0,2)**

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | UNIX Use of advanced vi commands. |  |
| **II** | Sorting of files containing records using sort command |  |
| **III** | Searching patterns in files. |  |
| **IV** | Use of bc, expr, factor commands. |  |
| **V** | Use of head, tail, compress commands |  |
| **VI** | Memory management commands, dfspace, du, ulimitetc |  |
|  | JAVA |  |
| **VII** | Programs based on matrix: addition, multiplication, transpose, check if matrix is symmetric / upper triangular / lower triangular / unit matrix. |  |
| **VIII** | Representation of complex numbers and their operation: add, multiply; divide, subtraction, magnitude (mod) etc. |  |
| **IX** | Complex matrix representation and operation: add, subtract, multiply. |  |
| **X** | Defining packages for sorting algorithms. |  |
| **XI** | File handling operations: input from file, output to file, file copy, file concatenation. |  |
| **XII** | Mouse and keyboard event handling programs. |  |
| **XIII** | Programs based on string operations. |  |
| **XIV** | Drawing in applet and use of buttons check boxes, text fields and labels in applets. |  |

**CP 320 DATA STRUCTURES IN C C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Performance Measurement:** Space complexity and Time complexity, big oh, omega and theta notations and their significance. Linear Lists **- Array** and linked representation, singly and doubly linked lists. Concept of circular linked lists. | **6** |
| **II** | **Array and Matrices:** Row and Column Major mapping and representation, irregular 2D array, Matrix operations, Special matrices: diagonal, tri-diagonal, triangular and symmetric. Sparse matrices representation and its transpose. | **6** |
| **III** | **Stacks:** Representation in array and linked lists, basic operation, Applications of stacks in parenthesis matching, towers of Hanoi etc. Queues **-** Representation in array and linked lists, applications, circular queues. | **8** |
| **IV** | **Trees:** Binary Tree, representation in array and linked lists, basic operation on binary trees, binary tree traversal (preorder, post order, in order). Search Trees **-** Binary search tree, indexed-binary search tree, basic operation, AVL tree, B-tree and Heap Tree. | **8** |
| **V** | **Graphs:** Representation of unweighted graphs, BFS, DFS, and Minimum cost spanning trees, Single source shortest path. Sorting **-** Bubble sort, insertion sort, merge sort, selection sort, quick sort, heap sort. | **8** |

**Reference:**

1) Data Structures in C by VikasThada, CBC Publishers.

2) Data Structures in C by Lipsutcz in Schaum Series.

3) Havowitz and Sawhni:Data structures in C and C++ (BPB Publication).

4) Tannenbaum:Data structures in C (PRENTICE HALL OF INDIA).

**CP 358 DATA STRUCTURES LAB C(L,T,P) = 1(0,0,2)**

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| **. No** | **LIST OF EXPERIMENTS** | **Total**  **Contact**  **Hrs. 02** |
| **I** | Simple array and sorting algorithm implementations. |  |
| **II** | Addition, multiplication and transpose of sparse matrices represented in array form. |  |
| **III** | Polynomial addition, multiplication (8th degree polynomials), using array and linked lists. |  |
| **IV** | Implementation of stack and queue using array and linked lists |  |
| **V** | Implementation of circular queue using array. |  |
| **VI** | Infix to postfix/prefix conversion. |  |
| **VII** | Binary search tree creation and traversing |  |
| **VIII** | Generation of spanning trees for a given graph using BFS and DFS algorithms. |  |
| **IX** | AVL tree implementation (creation, insertion, deletion). |  |
| **X** | Symbol table organization (Hash Table). |  |
| **XI** | Simple array and sorting algorithm implementations. |  |
| **XII** | Basic operation over linked list (add node, delete node). |  |

**CP 425 ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Artificial Intelligence:** Introduction to AI and knowledge based Expert systems: Introduction, Importance and Definition of AI, ES, ES building tools and shells. | **6** |
| **II** | **Knowledge Representation:** Concept of knowledge, Representation of knowledge using logics rules, frames. Procedural versus. Declarative knowledge, forward versus backward chaining. **Control Strategies: -**Concept of heuristic search, search techniques depth first search, Breath first search, Generate and test hill climbing, best first search. | **6** |
| **III** | **Artificial Neural Network:** Biological Neurons and synapses, characteristics Artificial Neural Networks, types of activation functions. **Perceptions:** Perception representation, limitations of perceptrons. Single layer and multiplayer perceptrons. Perceptron learning algorithms. | **8** |
| **IV** | **Basic Concepts in Learning ANN:** Supervised learning, Back propagation algorithm, unsupervised learning, Kohonen’s top field network and Algorithm. | **8** |
| **V** | **Fuzzy Logic:** Fuzzy logic concepts, Fuzzy relation and membership functions, Defuzzufication, Fuzzy controllers Genetic algorithm: concepts, coding, reproduction, crossover, mutation, scaling and fitness. | **8** |

**Reference:**

1) Elaine Rich and Kevin Knight, Artificial Intelligence, TATA MCGRAW HILL Publishers.

2) James A Anderson, An introduction to Neural Networks.

3) Dan. W Patterson, Artificial Intelligence and Expert Systems.

**CP 427 E-COMMERCE C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **INTRODUCTION AND CONCEPTS** : Network and Electronic Transmissions, Models for commercial Transactions; internet Environment online commercial solutions | **6** |
| **II** | **SECUIRTY TECHNOLOGIES** : why the internet is unsccure? What and where the risks are? Introduction to cryptography-Codes, Ciphers, securing algorithms. Public key solutions-Modular arthmetic, factoring and large numbers, public key encryption. Trusted key distribution and verifications. Cryptography Applications-Encryptions, Digital signature and No repudiation and Message Integrity. | **6** |
| **III** | **ELECTRONIC PAYMENT METHODS** : Updating Traditional Transactions, Secure online Transaction modules-secure web servers. Online secure processing. | **8** |
| **IV** | **PROTOCOLS FOR THE PUBLIC TRANSPORT OF PRIVATE INFORMATION :** Security protocols, secure Hypertext Transfer protocol-S-HTTP security features,secure http data transport, shttp header and message. Secure socket layer-SSL record specification, initiating and SSL session and other SSL options. Integrating security protocols into the web. Credit card business basics. Early SER trials-Visa, American Express, Certificate, Insurance. | **8** |
| **V** | **ELECTRONIC PAYMENT SYSTEM** : Digital payment system, first virtual internet payment fundamental assumptions, Account setup and costs, Confirming transaction and reducing Merchant Risk. Cybercash Model cybercash security and availability. Cybercash client application, selling through cybercash. | **8** |

**Reference:**

1) Pete Loshin-Electronic commerce, 2nd Ed., Jaico publishing House."

2) Mathew Raynolds-Beginning E-Commerce with Visual Basic,ASP, SQL Server 7.0 and

3) MTS, Shroff publishers and distributors Pvt. Ltd., Kolkata.

**CP 617 AI Application to Power Systems C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction to AI:** Definition, Applications, Components of an AI program; production system. Problem Characteristics. Overview of searching techniques. **Knowledge representation:** Knowledge representation issues; and overview. Representing knowledge using rules; procedural versus declarative knowledge. Logic programming, forward versus backward reasoning, matching. Control knowledge. | **6** |
| **II** | **Statistical Reasoning:** Probability and Baye's theorem. Certainty factor and rule based systems. Baysian Networks, Dampster Shafer theorem. Semantic nets and frames, Scripts. Examples of knowledge based systems. | **6** |
| **III** | Pattern Recognition: Introduction, automatic pattern recognition scheme. Design Concepts, Methodologies, Concepts of Classifier, concept of feature selection. Feature selection based on means and co-variances. Statistical classifier design algorithms; increment-correction and LMSE algorithms. Applications. | **8** |
| **IV** | **Artificial Neural Networks:** Biological Neuron, Neural Net, use of neural 'nets, applications, Perception, idea of single layer and multilayer neural nets, back propagation, Hopfield nets, supervised and unsupervised learning. | **8** |
| **V** | **Expert Systems:** Introduction. Study of some popular expert systems, Expert System building tools and Shells, Design of Expert Systems. | **8** |

**References:**

1) Elaine Rich and Kevin Knight, Artificial Intelligence, TMH Publishers.

2) James A Anderson, An introduction to Neural Networks.

3) Dan. W Patterson, Artificial Intelligence and Expert

**EC204 DIGITAL ELECTRONICS CIRCUITS C(L,T,P) = 4(3,1,0)**

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| **Unit** | **Course Contents** | **Hrs. 36** |
| 1 | **NUMBER SYSTEMS, BASIC LOGIC GATES and BOOLEAN ALGEBRA:** Binary Arithmetic and Radix representation of different numbers. Sign and magnitude representation, Fixed point representation, complement notation, various codes and arithmetic in different codes and their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, Nand, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and vica-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion. | 7 |
| II | **DIGITAL LOGIC GATE CHARACTERISTICS:** TTL logic gate characteristics. Theory and operation of TTL Nand gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS and CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS and MOSFET. Interfacing logic families to one another. | 7 |
| III | **MINIMIZATION TECHNIQUES:** Minterm, Maxterm, Karnaugh Map, K map upto 4 variables.Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions. Variable mapping. Quinn-McKlusky minimization techniques. | 7 |
| IV | **COMBINATIONAL SYSTEMS:** Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders. BCD adder. Binary multiplier. Decoder: Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, demultiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers. | 7 |
| V | **SEQUENTIAL SYSTEMS:** Latches, flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops. Counters: Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications. Registers: buffer register, shift register. | 7 |

**References:**

1) Malvino and Leach-Digital Principles and applications

2) M.Morris ,Mano-Digital Logic and Computer Design

3) S.Salivahnan, S.Anvazhagar- Digital circuit and Design

**EC 212 ADVANCE ELECTRONICS C(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Feedback Amlifiers:** Classification, Feedback concept, transfer gain with feedback. General characteristics of negative feedback amplifiers. Analysis of voltage series, voltage shunt, current series and current shunt feedback amplifiers. Stability criterion. | **6** |
| **II** | **Oscillators:** Classification of oscillators and Criterion for oscillation. RC-phase shift, Hartley, Colpitts, tuned collector, Wein Bridge and crystal oscillators. Astable, monostable and bistablemultivibrators. Schmitt trigger. | **6** |
| **III** | **OP-AMP and Its Applications:** Operational amplifier: inverting and non-inverting modes. Characteristics of ideal op-amp. Offset voltage and currents. Basic op-amp applications. Differential Amplifier and common mode rejection ratio. Differential DC amplifier and stable ac coupled amplifier. Integrator and differentiator. Analog computation, comparators, sample and hold circuits, logarithmic and antilog Amplifiers and Analog multipliers. | **8** |
| **IV** | **Integrated Circuits:** Precision AC/DC converters-precision limiting, Precision half wave and full wave rectifiers. Active average and peak detectors, A to D and D to A converters. IC 555 timer and its application. Regulated power supplies, Series and shunt voltage regulators, Brief idea of Monolithic regulator. | **8** |
| **V** | **Power Amplifiers:** Class –A large signal amplifiers, second harmonic distortion, higher order harmonic generation, Transformer coupled audio power amplifier, collector efficiency. Pushpull amplifier: Class A, Class B and Class AB operations. Comparison of performance with single ended amplifiers. | **8** |

**References:**

1) Millman and Halkias, Integrated Electronics, Analog and Digital circuit systems-TATA MCGRAW HILL

2) Jacob Millman and Arvin Grabel-Microelectronics. McGraw Hill

3) Boylsted and Nashishky, Electronic Devices and circuits, PRENTICE HALL OF INDIA.

**EC 221 ANALOG ELECTRONICS CIRCUITS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **PN Junction Diodes:** Open-circuited p-n junction & space charge region. The biased p-n junction, volt-ampere characteristics, cutin voltage & effect of temperature on V-I characteristics. Minority carrier density distribution in (i) a forward biased junction (ii) a reverse biased junction, diode capacitances, junction diode switching times & characteristics .**Other Diodes:** Avalanche breakdown &zener breakdown, working principles of zener diodes, photo-diodes, light emitting diodes, solar cell &varactor diodes. | **6** |
| **II** | **Analysis of Diode Circuits: D**iode as a circuit element, load line, small signal diode model and large signal diode model, analysis of half wave and full wave single-phase rectifiers, peak inverse voltage, various types of filters, their analysis and applications, voltage multipliers, clipping and clamping circuits. | **6** |
| **III** | **Bipolar Junction Transistors (BJT):** P-N-P and N-P-N transistors, transistor current components, common base (CB) and common emitter (CE) configurations: input and output characteristics, current Gains: alpha and beta, transistor operating regions: active region, saturation region and cutoff region, common collector configuration, BJT biasing and DC models, thermal stability and stabilization Techniques, small signal models: h-parameters and hybrid pie models, BJT as a switch, minority carrier concentration in the base for cutoff, active and saturation conditions, transistor switching times and characteristics, transistor ratings. HF and LF small signal model and analysis. | **8** |
| **IV** | **Field Effect Transistors:** Construction, working, V-I characteristics and transfer characteristics of JFET. MOSFET: Enhancement type and depletion type: construction, working, V-I characteristics, and transfer characteristics. DC analysis of FETs. FET as a voltage variable resistor. FET small signal models. FET as a switch. CMOS. Action characteristics biasing LF and HF small signal model and applications. | **8** |
| **V** | **Small Signal Amplifiers:** Analysis of BJT and JFET amplifiers at low frequency: input and out resistances, voltage and current gains, frequency response of common emitter transistor amplifier at high frequency. Miller’s theorem and its dual. Cascaded BJT amplifiers. Darlington pair and Bootstrapped Darlington circuit.**ElectronicsInstruments** : Oscillators, Digital Multimeter and its applications, CRO and its applications. | **8** |

**References:**

1. A.K.Sawhney, Electrical & Electronics Measurement & Instrumentation, DhanpatRai& Sons.
2. Millman and Halkias, Integrated Electronics, Analog and Digital circuit systems-TMH
3. Jacob Millman and Arvin Grabel-Microelectronics. McGraw Hill
4. Boylsted and Nashishky, Electronic Devices and circuits, PRENTICE HALL OF INDIA.
5. W.D. Cooper Electronic Instrumentation and Measurement Techniques, PHI.

**EC 223 SIGNALS AND SYSTEMS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Signals:** Introduction, Types of signals, Continuous-time and discrete time signals. Energy and Power, Transformations of the independent variable, Exponential and sinusoidal signals, Unit impulse and Unit sample signals, Continuous-time and Discrete time systems and Basic system properties. | **6** |
| **II** | **Linear time-invariant systems:** Discrete and Continuous time systems, convolution sum, convolution Integral, Properties, causal LTI systems described by difference equations, singularity function. | **6** |
| **III** | **Representation of periodic signal by Fourier:** Continuous-time and discrete-time signals, Properties.  **Representation of aperiodic signals by Fourier Transform:** Continuous-time and discrete-time signals, Properties, System characterized by linear constant coefficient differential equation. | **8** |
| **IV** | **Z-transform:** The region of Convergence, Inverse z-transform, pole zero plot, Properties of z-transform, Analysis and characterization of LTI system using z-Transform. **Sampling:** representation of Continuous-time signals by its samples, sampling theorem, Impulse train sampling, Sampling with zero order hold, Reconstruction of signal from its samples using interpolation, Aliasing. Discrete time processing of continuous time signals, Digital differentiator, half sample delay, Sampling of Discrete-time signals, Decimation and interpolation. | **8** |
| **V** | **Random signals:** review of probability theory, Random variable: Continuous and Discrete, Description of Continuous Random variable, Statistical averages. Description of Discrete Random variable, Statistical averages. **Random processes**: definition, properties and types. | **8** |

**References:**

1) Signals and Systems, A. V. Oppenheim, A. S Willsky, and S. H. Nawab, Prentice-Hall, Englewood Clieffs

2) Probability, random variables, and stochastic Processes, A. Papoulis, McGraw-Hill

3) Signals and Systems, B. P. Lathi

4) Signals and Systems, M. J. Roberts McGraw-Hill

**EC 252 ADVANCE ELECTRONICS LabORATORY C(L,T,P) = 1(0,0,2)**

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1KHz with and without negative feedback. |  |
| **II** | Study of series and shunt voltage regulators and measure line and load regulation and ripple factor |  |
| **III** | Plot and study the characteristics of small signal amplifier using FET |  |
| **IV** | Push Pull amplifier: To study variation of output power and distortion with load |  |
| **V** | Study Wein bridge oscillator and observe the effect of variation in R and C on oscillator frequency |  |
| **VI** | Study transistor phase shift oscillator and observe the effect of variation in R and C on oscillator frequency and compare with theoretical value. |  |
| **VII** | Study the following oscillators and observe the effect of variation of C on oscillator frequency:  (i) Hartley (ii) Colpitts |  |
| **VIII** | (i) Study op-amp in inverting and non-inverting modes. (ii) Use op-amp as scalar, summer and voltage follower |  |
| **IX** | Use of op-amp as differentiator and integrator. |  |
| **X** | Study Op-amp characteristics and get data for input bias current, measure the output-offset voltage and reduce it to zero and calculate slow rate. |  |
| **XI** | Obtain a frequency response of filters; **To plot the characteristics of UJT and UJT as relaxation** |  |
| **XII** | Analyze filter circuits to produce voltage frequency and phase-frequency response graphs using PSPICE |  |

**EC 253 ELECTRONICS LABORATORY - I C(L,T,P) = 1(0,0,2)**

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Study the following devices: (i) Analog and digital multimeter (ii) Function/ Signal generators (iii) Regulated d. c. power supplies (constant voltage and constant current operations) |  |
| **II** | Study of digital storage CRO and store a transient on it. |  |
| **III** | Study of analog CRO, CRO probes, measurement of time period, amplitude, frequency and phase angle using Lissajous figures. |  |
| **IV** | Plot V-I characteristic of P-N junction diode and calculate cut-in voltage, reverse Saturation current and static and dynamic resistances |  |
| **V** | Plot V-I characteristic of zener diode and study zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator. |  |
| **VI** | Plot frequency response curve for audio amplifier and to determine gain bandwidth product. |  |
| **VII** | Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of Idss and Vp |  |
| **VIII** | Plot gain- frequency characteristic of two stages RC coupled amplifier and calculate its bandwidth and compare it with theoretical value. |  |
| **IX** | Plot gain- frequency characteristic of emitter follower and find out its input and output resistances. |  |
| **X** | Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their hparameters |  |

**EC254 Digital Electronics CIRCUITS LabORATORY C(L,T,P) = 1(0,0,2)**

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Study of following combinational circuits: Multiplexer, Demultimplexer and Encoder. Verify truth tables of various logic functions. |  |
| **II** | Study of various combinational circuits based on: AND/NAND Logic blocks and OR/NOR Logic blocks |  |
| **III** | To study various waveforms at different points of a transistor bistablemultivibrator and its frequency variation with different parameters. |  |
| **IV** | To design a frequency divider using IC-555 timer. |  |
| **V** | To study various types of registers and counters |  |
| **VI** | To study Schmitt trigger circuit. |  |
| **VII** | To study transistor astablemultivibrator |  |
| **VIII** | Experimental study of characteristics of CMOS integrated circuits |  |
| **IX** | Interfacing of CMOS to TTL and TTL to CMOS. |  |
| **X** | BCD to binary conversion on digital IC trainer. |  |
| **XI** | Testing of digital IC by automatic digital IC trainer. |  |
| **XII** | To study OP-AMP as Current to Voltage and Voltage to Current converters and comparator |  |

**EC 314 MICROPROCESSOR AND COMPUTER ARCHITECTURE II C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **8086 Microprocessor:** Hardware specifications, architecture, address spaces, clock generator, bus controller and arbiter, Minimum and maximum mode, System Bus Timing. | **6** |
| **II** | **Software and Instruction Set:** Assembly language programming: addressing mode and instructions of 8086, linking and execution of programs, MACRO programming, assembler directives and operators. | **6** |
| **III** | **I / O Interfaces:** Programmable peripheral interfacing **(**8255, 8155), Programmable Timer interfacing (8253,8254), Programmable interrupt controller (8259) Serial Communication interfaces. | **8** |
| **IV** | **Data and Memory Interfacing:** A/D, D/A converter interfacing, Memory interfacing and Decoding, DMA controller. | **8** |
| **V** | **Multiprocessor Configurations:** 8086 based Multiprocessor systems. 8087 Numeric data processor. | **8** |

**References:**

1) Gaonkar:Microprocessors.

2) Douglas Hall:Digital Electronics and Microprocessors.

3) B.Ram.Microprocessors.

4) Morris Mono:digital electronics.

**EC 315 MICRO PROCESSOR AND COMPUTER ARCHITECTURE C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction**: CPU, address bus, data bus and control bus. Input/Output devices, buffers, encoders, latches and memories. Brief introduction to comparison of different features in 8085 and 8086 microprocessors | **6** |
| **II** | **8085 Microprocessor Architecture**: Internal Data Operations and Registers, Pins and Signals, Peripheral Devices and Memory Organization, Interrupts. | **6** |
| **III** | **8085 Microprocessor Instructions**: Classification, Format and Timing. Instruction Set. Programming and Debugging, 8 Bit And 16 Bit Instructions. | **8** |
| **IV** | **8085 Microprocessor Interfacing**: 8259, 8257, 8255, 8253, 8155 chips and their applications. A/D conversion, memory, keyboard and display interface (8279). | **8** |
| **V** | **Basic Computer Architecture:** Central Processing Unit, memory and input/output interfacing. Memory Classification: Volatile and non-volatile memory, Primary and secondary memory, Static and Dynamic memory, Logical, Virtual and Physical memory. Types of memory: Magnetic core memory, binary cell, Rom architecture and different types of ROM, RAM architecture, PROM, PAL, PLA, Flash and Cache memory, SDRAM, RDRAM and DDRAM. Memory latency, memory bandwidth, memory seek time. | **8** |

**References:**  
1)Gaonkar: Microprocessors. Douglas Hall:  
2) Digital Electronics and Microprocessors ,  
3)B.Ram. Microprocessors.  
4)Morris Mono: digital electronics

**EC 316 FUNDAMENTALS OF DIGITAL COMMUNICATION C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **PCM and DELTA Modulation Systems:** PCM and delta modulation, quantization noise in PCM and delta modulation. Signal-to-noise ratio in PCM and delta modulation, T1 Carrier System, Comparison of PCM and DM. Adaptive delta Modulation. Bit, word and frame synchronization, Matched filter detection. | **6** |
| **II** | **Digital Modulation Techniques:** Various techniques of phase shift, amplitude shift and frequency shift keying. Minimum shift keying. Modulation and Demodulation. | **6** |
| **III** | **Error Probability in Digital Modulation:** Calculation of error probabilities for PSK, ASK, FSK and MSK techniques. | **8** |
| **IV** | **Information Theory:** Amount of Information, Average Information, Entropy, Information rate, Increase in Average information per bit by coding, Shannon's Theorem and Shannon's bound, Capacity of a Gaussian Channel, BW-S/N trade off, Orthogonal signal transmission. | **8** |
| **V** | **Coding:** Coding of Information, Hamming code, Single Parity-Bit Code, Linear Block code, cyclic code and convolution code. | **8** |

**References:**

1)Digital Communication by Simon Hykin by John Wiley and Sons.  
2) Digital Communication by P.Chakraborty.Dhanpat Rai and Sons.

3) Principle of Communication systems by Taub SCHILLING, TATA MCGRAW HILL

**EC 317 PRINCIPLE OF COMMUNICATION SYSTEMS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Noise Effects in Communication Systems:** Resistor noise, Networks with reactive elements, Noise temperature, Noise bandwidth, effective input noise temperature, Noise figure. Noise figure and equivalent noise temperature in cascaded circuits. | **6** |
| **II** | **Amplitude Modulation:** Frequency translation, Recovery of base band signal, Spectrum and power relations in AM systems. Methods of generation and demodulation of AM-DSB, AMDSB/ SC and AM-SSB signals. Modulation and detector circuits for AM systems. AM transmitters and receivers. | **6** |
| **III** | **Frequency Modulation:** Phase and freq. modulation and their relationship, Spectrum and bandwidth of a sinusoidally modulated FM signal, phasor diagram, Narrow band and wide band FM. Generation and demodulation of FM signals. FM transmitters and receivers, Comparison of AM, FM and PM. Pre emphasis and de-emphasis. Threshold in FM, PLL demodulator. | **8** |
| **IV** | **Noise in AM and FM:** Calculation of signal-to-noise ratio in SSB-SC, DSB-SC, DSB with carrier, Noise calculation of square law demodulator and envelope detector. Calculation of S/N ratio in FM demodulators, Super-heterodyne receivers. | **8** |
| **V** | **Pulse Modulation Systems:** Sampling theorem, Generation and demodulation methods of PAM, PWM, PPM. | **8** |

**References:**

1) Taub Schilling -Principle of communicatin systems

2) Signals and Systems, B. P. Lathi

3) Signals and Systems, M. J. Roberts McGraw-Hill

5) J.B.GUPTA: Switchgear protection. Kataria Publications, New Delhi.

**EC 325 EMBEDDED SYSTEMS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction**: Introduction to embedded systems, their characteristics, modeling of systems, system specifications, specification languages, study of specification example. | **6** |
| **II** | **Translation**: Specification translation, translation of various features such as state transition, message passing communication, concurrency, exception handling etc. | **6** |
| **III** | **System partitioning**: Introduction, partitioning issues, partitioning algoritms, functional portioning, hardware/software partitioning algorithms, functional partitioning for systems. | **8** |
| **IV** | **Design quality estimation**: Quality metrics, hardware estimation, software estimation. | **8** |
| **V** | **Specification refinement**: Refining variable grouping, channel refinement, resolving accesss conflict, refining incompatible interfaces, refining hardware/software interfaces. Study of a system design methodology and study of generic synthesis system. | **8** |

**References:**

1) Specification and design of embedded systems, David D Gajski, Frandkvahid, S. Narayan, J Garg.

2) Embedded system design, Heath Steve and Newns 1997.

3) Art of programming Embedded Systems, J. Gassle.

# EC 355 MICROPROCESSOR LAB C(L,T,P) = 1(0,0,2)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Study the hardware, functions, memory structure and operation of 8085-Microprocessor kit. |  |
| **II** | Program to perform integer division: (1) 8-bit by 8-bit (2) 16 bit by 8 bit. |  |
| **III** | Transfer of a block of data in memory to another place in memory in direct and reverse order |  |
| **IV** | Searching a number in an array and finding its parity. |  |
| **V** | Sorting of array in: (1) Ascending order (2) Descending order. |  |
| **VI** | Program to perform following conversion (1) BCD to ASCII (2) BCD to hexadecimal. |  |
| **VII** | Program to multiply two 8–bit numbers |  |
| **VIII** | Program to generate and sum 15 Fibonacci numbers. |  |
| **IX** | Program for rolling display of message “India”, “HELLO”. |  |
| **X** | To insert a number at correct place in a sorted array. |  |
| **X1** | Serial and Parallel data transfer on output port 8155 and 8255 and implementation of disco light, running light, and sequential lights on the above mentioned hardware. |  |
| **XII** | Generation of different waveform on 8253/8254 programmable timer |  |

**IT 304 WEB TEHNOLOGY C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | INTRODUCTION: What is Internet? Introducing web browsers with specific reference to net scape and internet explorer, http, ftp, file type URLs, Image, audio or video formats like jpeg, gif, png, avi, mpeg, mp3.Markup concept and its use in markup languages. | **6** |
| **II** | BASIC HTML 4.0 ELEMENTS : Basic structure of an HTML document, doctype, Meta data, Link, displaying images, various fonts, colors, sizes and alignments of texts. Lists and Tags. | **6** |
| **III** | STYLE SHEET, TABLES : CSSI standard, including style sheets. Applying styles to specific groups of elements, creating overall look for the web page. Basic Table elements, combining the tables and CSSI style sheet. | **8** |
| **IV** | CREATING FORMS;FRAMES and FRAMESETS : What are forms? Buttons, Text field,selection list, Radio button and check boxes on a web page submitting and resetting forms with submit and reset button. Creating and working with frames. | **8** |
| **V** | EVENT DRIVEN PROGRAMMING IN JAVA APPLET : Applet Architecture and its start, stop, in it, paint, update and repaint methods, drawing string, lines, polygons Ellipses and circles using abstract windows tool kit package and its classes. Working with colors and fonts. Running Applets from HTML with/without PARAM Tag. Using button, check box group, choice, List point, Text field, Text area classes, Border Layout, card layout and Grid layout. Layout managers. | **8** |

**Reference:**

1) Dynamic web publishing 2nd Edition by shelly powers, Techmedia publishers.

2) Java 2-The complete reference 4th Edition by Herbert Schildt, Tata McGraw Hill.

3) Learn HTML IN 24 Hrs by Techmedia publishers.

**IT 457 Information Technology Lab C(L,T,P) = 1(0,0,2)**

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Create a web page of meaningful story or description using various tags i.e. <u>, <i>, <b>, <big>, <small>, <large>, <tt>, <s>, <p>, <marquee> etc. |  |
| **II** | Create a web page of learning various lists e.g. ordered lists, unordered lists, definition lists and hence inscribe meaning list of various fields for e.g. academics, sports, politics etc. |  |
| **III** | Create a web page of learning usage of tables |  |
| **IV** | Create a web page of learning usage of frames. |  |
| **V** | Create a web page of learning usage of target and hyperlinks (same page and different page linking). |  |
| **VI** | Create a web page of learning usage of forms, using various buttons and fields |  |
| **VII** | Create a web page of your own description using all the information learned above |  |

**MA 201 Integral Transforms & Complex Analysis C(L,T,P) =4(3,1,0)**

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| **Unit** | **Course Contents** | **Hrs.** |
| 1 | **BOUNDARY VALUE PROBLEMS: –** Method of separation of variables in the solution of Boundary VALUE Problems (Wave equation, Diffusion and Laplace equation) | 7 |
| II | **LAPLACE TRANSFORM -** Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficients with special reference to the wave and diffusion equations. | 7 |
| III | **FOURIER TRANSFORM -** Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant co-efficient with special reference to heat equation and wave equation. | 7 |
| IV | **COMPLEX VARIABLES I -** Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy;s theorem. Cauchy’s integral formula | 7 |
| V | **COMPLEX VARIABLES II -**Taylor’s series Laurent’s series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration | 7 |
|  | **Total** | 35 |

**Reference Books**

Advanced Mathematics for Engineers by Chandrika Prasad

Higher Engineering Mathematics by BS Grewal

Higher Engineering Mathematics by YN Gaur

Higher Engineering Mathematics by KC Jain

**MA 202 NUMERICAL ANALYSIS AND STATISTICSC(L,T,P) = 4(3,1,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Numerical Analysis:** Finite differences - Forward backward and central difference. Newton’s forward and backward differences interpolation formulae. Sterling’s formulae, Lagrange’s interpolation formula. Solution of non-linear equations in one variable by Newton Raphson and Simultaneous algebraic equation by Gauss and RegulaFalsi method. Solution of simultaneous equations by Gauss elimination and Gauss Seidel methods. Fitting of curves (straight line and parabola of second degree) by method of least squares. | **6** |
| **II** | **Numerical Analysis:** Numerical differentiation, numerical integration trapezoidal rule, Simpson’s one-third and one eighth rule. Numerical Integration of ordinary differential equations of first order, Picard’s method, Euler’s and modified Euler’s methods. Miline’s method and RungaKutta fourth order method. Simple linear difference equations with constant coefficients. | **6** |
| **III** | **Special Functions:** Bessel’s function of first and second kind, simple recurrence relations, orthogonal property of Bessel functions, Transformation, Generating functions, Legendre’s function of first kind, simple recurrence relations, orthogonal property, Generating functions. | **8** |
| **IV** | **Statistics and Probability:** Elementary theory of probability, Baye’s theorem with simple applications, Expected value. Theoretical probability distributions – Binomial, Poisson and Normal distributions. | **8** |
| **V** | **Statistics and Probability:** Lines of regression, co-relation and rank correlation. **Transforms**: Z-transforms, its inverse, simple properties and application to difference equations. | **8** |

**References:**

1) Chandrika Prasad – Advanced Mathematics for Engineers.

2) B.S.Grewal-Higher Engineering Mathematics

3)Gokhroo and Mehta- Advanced Engineering Maths. Unique Books-Ajmer

**MA 305 OPERATION RESEARCH C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **INTRODUCTION** : Introduction, Engineering application of optimization, statement of an optimization problem, classification of optimization problems. Single variable and multivariable optimization with and without constraints. | **6** |
| **II** | **PERT and CPM**: Introduction to various components, advantages and disadvantages of PERT AND CPM. Probabilistic estimate of job using PERT. | **6** |
| **III** | **LINEAR PROGRAMMING** : Single and multivariable optimization. Graphical interpretation pivotal reduction of general systems of equations. Simplex method. Transportation and Assignment problems. | **8** |
| **IV** | **NON LINEAR PROGRAMMING** : Unconstrained Optimization techniques: Direct search method, random search method, univariate method and pattern search method. Basic idea of Hooks and Heaves, Simplex, Powell and Newton methods. | **8** |
| **V** | **Dynamic Programming :** Introduction, solving linear programming problem and non linear programming problem using dynamic programming. | **8** |

**References:**

1) S.S Rao:Optimization theory and application, wiley eastern limited.

2) Goel and Mittal: Operation Research

**EE 501 POWER SYSTEM ANALYSIS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Fault Analysis:** Positive. Negative and Zero Sequence equivalent circuits of lines, two and three winding transformers, induction machines and synchronous machines. Analysis of shunt and series faults, effect of neutral grounding. | **6** |
| **II** | **Unbalanced Operation of 3-phase Induction Motors:** Characteristics with application of unbalanced voltage to a balanced motor and with application of balanced voltage to a motor having unbalanced impedances in the rotor circuit. | **6** |
| **III** | **Synchronous Machines:** Short circuit currents and reactances of synchronous machine. Modelling of synchronous machine at no load and symmetrical load under steady state conditions, Sequence impedance of synchronous machines. | **8** |
| **IV** | **Linear Graph Theory:** Study of linear graph theory, Network topology, incidence, Cut-set and Tie-set matrices and their interpretation. Calculation of Z-bus, Y-bus, Z-branch and Y loop matrices by singular and non-singular transformations. Algorithm for the calculation of Y-bus and Z-bus. Fault calculations using Z-bus. | **8** |
| **V** | **Load Flow Studies:** Formulation of load flow problem. Various types of buses. Gause-Siedel, Newton-Raphson and Fast Decoupled Algorithms. Calculation of reactive power at voltage controlled buses in the Gauses-Seidel iterative method using Y-bus, Representation of transformers - Fixed tap setting transformer, Tap changing under load transformers, Phase shifting transformers, Tie line control, Comparison of methods for load flow. | **8** |

# Reference:

1) J.J. Grainger,William, D.StevensonJr Power system Analysis.   
2) C L Wadhwa, Electrical power system.New Age international publishers.   
3) B.R.Gupta: Power system Analysis and Design.

**EE502 POWER SYSTEM STABILITY C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Modeling of synchronous machines:**Modeling of cylindrical rotor salient pole synchronous machines, flux linkage equations, voltage equations, Park's transformation, various inductances and time constraints of synchronous machines, vector diagrams for steady state and transient conditions, power angle curves. | **6** |
| **II** | **Stabilities:** Steady state and transient stabilities, their definitions and methods of determination. Development of Swing equation. | **6** |
| **III** | **Machine Systems:** Steady state stability of single machine connected to an infinite bus by the method of small oscillations. Two machine systems. Coherent and non-coherent machines. | **8** |
| **IV** | S**tudy of various stability methods:** Equal area criterion of determining transient stability, fault clearing time and critical clearing angle. Solution of Swing equation by step by step method. Euler's Method and Runga-Kutta Method, Application of Computers in the study of transient stability using these methods. Introduction to steady state and transient Stability using these methods. Introduction to steady state and transient stabilities of multi-machine system without controller. | **8** |
| **V** | **Factors affecting Stabilities:** Factors affecting steady state and transient stabilities, methods of improving steady state and transient stabilities, high speed circuit breakers, auto-reclosing circuit breaker, single pole operation, excitation control, and bypass valving. | **8** |

**References:**  
1) C L Wadhwa, Electrical power system.New Age international publishers.   
2) B.R.Gupta: Power system Analysis and Design.

**EE 504 HVDC TRANSMISSION C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Thyristor Valve:** Thyristor device, Steady state and switching characteristics, Light activated power thyristor, LED, fiber optics, valve firing, parallel and series connections of thyristors. | **6** |
| **II** | **Converter Circuits:** Rectification and inversion, affect of reactance, six pulse and twelve pulse converter circuits. | **6** |
| **III** | **DC Link Control:** Principles of DC link control, Converter control characteristics, System control hierarchy, Firing angle control, Extinction angle control, starting, stopping and power flow reversal of DC link, Power control, and Parallel operation of DC link with AC transmission line. Converter faults, commutation failure, valve blocking and bypassing. Protection against over currents, over voltages. DC circuit breakers. Reactive Power Control: Reactive power requirement in steady state, Sources of reactive power and reactive power control. | **8** |
| **IV** | **(i) Harmonic and Filters:** Generation of harmonics, AC and DC side harmonics, Characteristics and non-characteristics harmonics. Types of AC filters – single tuned and double tuned filters, high pass filter, DC Smoothing reactor and filters.  (ii) Scheme of a HVDC converter station and components of HVDC transmission system. | **8** |
| **V** | **Multi Terminal DC (MTDC) Systems:** Types of MTDC systems, Comparison of series and parallel MTDC systems, Control and protection of MTDC systems, Application of MTDC systems. | **8** |

**References:**1)K.R. Padiyar-HVDC Power Transmission System.  
2)Power System Engineering by C.M.Arora.

**EE 506 POWER SYSTEM TRANSIENTS AND PROTECTION C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | Wave terminology, development of wave equations, terminal problems, lattice diagrams.Origin and nature of power system surges, wave shapes, attenuation, effect of shielding by ground wires and masts, tower footing-resistance. Traveling waves, multi-velocity waves, methods of measuring tower footing resistance, voltages across insulator strings. Dynamic over voltages during surges and system faults, system recovery voltage characteristics. | **6** |
| **II** | **Neutral Grounding:** Methods of neutral grounding and their effect on system behaviour. Insulation coordination, requirement in surge protection of lines and equipment. | **6** |
| **III** | **Static Relays:** Introduction, advantages of static relays over electromagnetic relays. Limitation of static relays, Reliability and Security of static relays, Recent Developments of static relays. | **8** |
| **IV** | **Comparators:** Comparators and Level Detectors: Static Relay Functional circuits, Amplitude and Phase comparators, level detectors. Digital Relays, Microprocessor based protective relays. | **8** |
| **V** | **Switchgear:** Types of circuit breakers and their constructional features, operating mechanism Application of Circuit breakers, speed of circuit breakers, Auto reclosing, selection of circuit breakers, Rating of circuit breakers, Testing of circuit breakers, SF6 Insulated Metal clad Switchgear (CIS), Advantages, Demerits, Design aspects, Busbar modules, SF6 , Insulated EHV Transmission Cables (GIC). | **8** |

**References:**  
1)MChander:Switchgear protection.  
2) S SRao:Switchgear and protection.   
3) T M S Rao:Static Relays.  
4) C.L.Wadhwa-Electrical Power system.  
5) J.B.GUPTA: Switchgear protection. Kataria Publications, New Delhi.6) Kamraj and Naidu: High voltage Engineering, TATA MCGRAW HILL

**EE 508 ADVANCED POWER SYSTEM C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Voltage Stability:** Power system voltage stability concept, comparison of angle and voltage stabilities, Power system loads, generator P-Q and Q-V characteristics. Voltage collapse. Voltage stability analysis. Methods of improving voltage stability. | **6** |
| **II** | **Distribution Automation:** Introduction to distribution automation. Concepts ofcommunication - power line carrier, radio communication, fibre optics, satelliteCommunication and sensors. Introduction to supervisory control and data acquisition (SCADA). Brief description of an automation system. | **6** |
| **III** | **FACTS:** Problem of AC transmission systems, basic principle of power flow control of an AC transmission line. Basic types of FACTS controllers. Brief description of FACTS controllers- STATCOM, Static Voltage and phase angle regulators, thyristor switched and thyristor controlled series capacitors, Unified Power Flow Controller. | **8** |
| **IV** | **Energy Conservation:** Introduction, conservation of natural resources, principles of energy conservation and energy audit. Brief description of energy conservation in power plants, electric utilities, electric drives, industries and electric lighting. | **8** |
| **V** | **Superconductivity:** Basic characteristics of superconductors. Brief description of applications of superconductivity to electric power systems - superconducting generators, motors, transformers, transmission cables and magnetic storage. | **8** |

**References:**1) C L Wadhwa, Electrical power system.New Age international publishers. 2) B.R.Gupta: Power system Analysis and Design.

**EE 503 ADVANCED POWER ELECTRONICS C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36.** |
| **I** | **Phase Controlled Converters:** Performance measures of single and three-phase converterswith discontinuous load current for R, RL and RLE loads. Effect of source inductance forsingle and three-phase converters | **6** |
| **II** | **Chopper-**Review of choppers configurations, Steady state analysis of type A Chopper-Minimum and Maximum Currents, Ripple and average load current. Commutation in ChopperCircuits. | **6** |
| **III** | **Inverters:** Performance parameters, voltage control of three phase inverters-Sinusoidal PWM,Third Harmonic PWM, 60 degree PWM and Space Vector Modulation. Harmonic reductions | **8** |
| **IV** | **AC Voltage Controllers:** Single and Three Phase AC Controllers. AC Voltage Controllerwith PWM Control. | **8** |
| **V** | **Cyclo-converters:** Single phase and three phase Cyclo-converters. Reduction in OutputHarmonics.matrixconvertyer. | **8** |

**References:**  
1) C L Wadhwa, Electrical power system.New Age international publishers.   
2) B.R.Gupta: Power system Analysis and Design.

**EE 510 ADVANCED CIRCUIT ANALYSIS AND DESIGN C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Network Topology:** Network geometry, incidence matrix, tie-set matrix and loop currents, cut-set matrix, and node pair potentials. Properties of cut-set and tie-set matrices, f–cutset Analysis, f-circuit Analysis, Node-pair Analysis. Duality, planner and non-planner networks. Branch parameters matrices. Kirchhoff's equilibrium equations on loop basic. Equilibrium equations on the node basis. | **6** |
| **II** | **Network Functions:** Network functions, evaluation of network function from (1) a given magnitude (2) a given angle and (3) a given real part; integral relationship between real and imaginary parts. | **6** |
| **III** | **Elements of Reliability:** Driving point functions, Brune's positive real functions, properties of positive real functions. Testing driving point functions An application of the maximum modulus theorem, properties of hurwitz polynomials, the computation of residues, even & odd functions, Sturm's theorem, An alternative test for positive real character. Driving point synthesis with LC elements: Elementary synthesis operations, LC Network Synthesis. **RC and RL Networks:** Properties of RC network functions, foster form of RC networks, foster form of RL networks. The caur form of RC and RL networks, RLC one Terminal-Pairs: Minimum positive real functions. Brune’s method of RLC synthesis. | **8** |
| **IV** | **Attenuators and Equalizers:** Symmetrical Bridge-Tand lattice attenuators, asymmetrical T and π attenuators. Equalizer configuration, four terminal equalizers, full -series, shunt and bridge-T and lattice equalizers. | **8** |
| **V** | **Active RC filters and Computer Application:** Introduction to active RC filters Realisable approximation to Ideal filter, constant time delay & Thompson filter, frequency transformation, Active RC filter, Multi amplifier Biquad realization. Fixed capacitor filter. **Computer Application:** Network solution by matrix Inversion- Gauss Elimination Method, Computer Programme for plotting transient response, Computer Programme for finding roots of polynomial equations. | **8** |

**References:**

1. D. Roy Choudhary, ‘Networks and Systems’
2. W. H. Hayt and J. E. Kemmerly, Engineering circuit Analysis, TMH.
3. A Chakrabarti and S. Bhadra, ‘Networks and Systems’ DhanpatRai and Co.
4. M.E. Van Valkenberg, ‘Network Analysis’ Prentice Hall

# EE 551 MATLAB PROGRAMMING LAB C(L,T,P) = 1(0,0,2)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs. Scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects.Multi-dimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets) |  |
| **II** | **Simulink:** Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets) |  |

**EE 552 POWER SYSTEM MODELLING & SIMULATION LAB C(L,T,P) = 3(3,0,0)**

|  |  |  |
| --- | --- | --- |
| **UNIT** | **LIST OF EXPERIMENTS** | **Total**  **Contact**  **Hrs. 36.** |
| **I** | Simulate Swing Equation in Simulink (MATLAB) | **6** |
| **II** | Modelling of Synchronous Machine .Modelling of Induction Machine. | **6** |
| **III** | Simulate simple circuits using Circuit Maker | **8** |
| **IV** | (a) Modelling of Synchronous Machine with PSS (b) Simulation of Synchronous Machine with FACTS device.  (b) Modelling of Synchronous Machine with FACTS device (b) Simulation of Synchronous Machine with FACTS devices. | **8** |
| **V** | FACTS Controller designs with FACT devices for SMIB system. | **8** |

**EE 601 Power System Planning AND Reliability C(L,T,P) = 3(3,0,0)**

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| --- | --- | --- |
| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Load forecasting:** Classification and characteristics of loads. Approaches to load forecasting. Forecasting methodology. Energy forecasting. | **6** |
| **II** | **Basic Reliability Concepts:** General reliability function, Markov Chains and processes and their applications, simple series and parallel system models. | **6** |
| **III** | **Static Generating Capacity Reliability Evaluation:** Outage definitions, loss of load probability methods, loss of energy probability method. Frequency and duration methods, load forecasting uncertainty. | **8** |
| **IV** | **Spinning Generating Capacity Reliability Evaluation:** Spinning capacity evaluation, load forecast uncertainty. | **8** |
| **V** | **Transmission System Reliability Evaluation:** Average interruption rate method. The frequency and duration method. Stormy and normal weather effects.Inter-connected Systems Generating Capacity Reliability Evaluation: Introduction, The loss of toad approach.Reliability evaluation in two and more than two interconnected systems. Interconnection benefits. | **8** |

**Reference:**

1) Roy Billinton and Ronald N.Allan-Reliability Evaluation of power system volume-I

2) Roy Billinton and Ronald N.Allan-Reliability evaluation of power System volume-II

3) J Endreny-Reliability modelling in electric power system.

4) A.S. Pabla-Electric power distribution.

**EE 603 OPERATION & CONTROL OF POWER SYSTEMS C(L,T,P) = 3(3,0,0)**

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| --- | --- | --- |
| **UNIT** | **COURSE CONTENTS** | **Hrs. 36.** |
| **I** | **Optimal Power System Operation:** System constraints. Generator operating cost. Input-Output and incremental fuel characteristics of a generating unit. Optimal operation ofgenerators on a bus bar, algorithm and flow chart. Optimal unit commitment, constraints in unit  commitment, spinning reserve, thermal and hydro constraints. | **6** |
| **II** | **Unit Commitment Solution Methods:** Priority list method and dynamic programmingmethod. Reliability consideration, Patton’s security function, security constrained optional unitcommitment, start- up considerations | **6** |
| **III** | **Optimal Generation Scheduling:** Development of transmission loss and incremental lossequations. Optimal generation scheduling including transmission losses, algorithm and flowchart. Optimal load flow solution. Hydrothermal coordination | **8** |
| **IV** | **Load Frequency Control:** Control of real and reactive power of generator. Turbine speedgoverning system, Modelling of speed governing system. Methods of frequency control: flatfrequency, flat tie line and tie line load bias control. Block diagram representation of loadfrequency control of an isolated system, steady state analysis, dynamic response. Introductionto Two – area load frequency control | **8** |
| **V** | **(i) Power System Security**: Introduction to power system security, System monitoring,contingency analysis, System state classification, security control.**(ii) Automatic Generation Control:** Speed governing characteristic of a generating unit. Loadsharing between parallel operating generators. Introduction to automatic generation control ofan area by computer (description of block diagram) | **8** |

**References:**

1. S. Sivanagaraju, G. Sreenivasan, “Power System Operation and Control”1st edition, Pearson Publication, 2010
2. D.P. Kothari, I.J. Nagrath, “Modern Power System Analysis”4th Edition, Tata McGraw Hill, 2011
3. C.L. Wadhwa “Electrical Power Systems”, 6th Edition, New Age International, 2012

**EE 605 ADVANCE THEORY AND ANALYSIS OF AC MACHINES C(L,T,P) = 3(3,0,0)**

|  |  |  |
| --- | --- | --- |
| **UNIT** | **COURSE CONTENTS** | **Hrs. 36.** |
| **I** | **Introduction:** Physical model, Different reference frame, Transformations, Primitive Machine, Dynamic variable, Formulation of dynamic equations of a generalized machine. | **6** |
| **II** | **Maxwell equations:** Introduction to Maxwell equations**,** Electric field of Transformers, Shaft voltages and fluxes, bearing currents. | **6** |
| **III** | **Induction machines:** Induction motor modeling, oscillations In Induction machines, Asymmetries in stator and rotor windings. | **8** |
| **IV** | **Synchronous machine:** Asynchronous-synchronous Operation of synchronous machine; Modeling, Operational Impedances, Time constants, Stability, Power angle characteristics. | **8** |
| **V** | **Short circuit analysis:** Symmetrical and Asymmetrical short circuit analysis, Measurement of Reactance, Power Systems. | **8** |

**References:**  
1) P.S Bimbhra, Generalised Theory of Electrical Machines, Khanna Publishers.   
2) A.E Fitzgerald, Charles Kingsley, Jr. and S D Umans, Electrical Machinery, 4th Ed., MGH Publishers.   
3) C.V Jones Unified Theory of Electrical Machines, Butterworths, London 1967.

**EE 607 Excitation of synchronous machines and their controlC(L,T,P) = 3(3,0,0)**

|  |  |  |
| --- | --- | --- |
| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Excitation Systems:** Principal Controls of a generating unit. Arrangement of excitation components, voltage response-ratio. Excitation specifications. Ceiling voltage, time constant and response of excitation systems. Requirements of excitation systems: Classification of excitation systems. | **6** |
| **II** | **D.C. Excitation Systems:** configuration of DC excitation system with main and pilot exciters. Amplidyne and magnetic amplifier. Automatic voltage regulator with magnetic amplifier and Amplidyne. Limitation and problems of DC excitation systems. Improvement in DC excitation system. | **6** |
| **III** | **AC Shunt Excitation Systems (Static Rectifier Excitation Systems):** Static thyristor rectifier schemes. Transient Response during fault condition. Use of booster transformer. Application for shunt excitation systems. | **8** |
| **IV** | **AC Separately Excitation Systems. (Alternator- Rectifier Excitation System):** Scheme of alternator-rectifier excitation system with (i) diode rectifier and (ii) thyristor rectifier. Comparison and Application of these schemes. Harmful effects of static excitation systems or system machine components, means of prevention.  **Brushless Excitation Systems:** Brush-slip ring problem. Scheme of Brushless excitation system with rotating diode. Control, protection and monitoring of Brushless excitation system. Introduction to brushless excitation system with rotating thyristors. Introduction to Superconducting Exciter. | **8** |
| **V** | **Automatic Voltage Regulator (AVR) AND Excitation Control:** Solid state automatic voltage regulator scheme. Auto and manual follow-up. Thyristor converter and AVR protection. Introduction to Digital AVR.  **Excitation Control:** Introduction to power stabilizing signal-speed, frequency and power signals. Rotor current limiter, MVAR limiter. Effect of excitation on generator power limits, Dynamic and Transient stabilities. | **8** |

**References:**  
1)A E Fitzgerald. Charles Kingsley, Jr. and S D Umans, Electrical Machinery, 4th Ed., MGH Publishers.   
2) C V Jones Unified Theory of Electrical Machines, Butterworths, London 1967

# EE 651 COMPUTER BASED POWER SYSTEM DESIGN LAB C(L,T,P) = 1(0,0,3)

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| **S. No** | **LIST OF EXPERIMENTS** | **Hrs. 02** |
| **I** | 1 Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases:  (i) LG Fault  (ii) LLG Fault  (iii) LL Fault and  (iv) 3-Phase Fault |  |
| **II** | Load flow analysis for a given system (for 3 to 6 bus) using  (i) Gauss Seidal  (ii) Newton Raphson  (iii) Fast Decoupled Method and verify results using MATLAB or any available software |  |
| **III** | Study of voltage security analysis |  |
| **IV** | Study of overload security analysis and obtain results for the given problem using MATLAB or any software |  |
| **V** | Study of economic load dispatch problem with different methods |  |
| **VI** | Study of transient stability analysis using MATLAB/ETAP Software. |  |

**CP 617 AI Application to Power Systems C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction to AI:** Definition, Applications, Components of an AI program; production system. Problem Characteristics. Overview of searching techniques. **Knowledge representation:** Knowledge representation issues; and overview. Representing knowledge using rules; procedural versus declarative knowledge. Logic programming, forward versus backward reasoning, matching. Control knowledge. | **6** |
| **II** | **Statistical Reasoning:** Probability and Baye's theorem. Certainty factor and rule based systems. Baysian Networks, Dampster Shafer theorem. Semantic nets and frames, Scripts. Examples of knowledge based systems. | **6** |
| **III** | Pattern Recognition: Introduction, automatic pattern recognition scheme. Design Concepts, Methodologies, Concepts of Classifier, concept of feature selection. Feature selection based on means and co-variances. Statistical classifier design algorithms; increment-correction and LMSE algorithms. Applications. | **8** |
| **IV** | **Artificial Neural Networks:** Biological Neuron, Neural Net, use of neural 'nets, applications, Perception, idea of single layer and multilayer neural nets, back propagation, Hopfield nets, supervised and unsupervised learning. | **8** |
| **V** | **Expert Systems:** Introduction. Study of some popular expert systems, Expert System building tools and Shells, Design of Expert Systems. | **8** |

**References:**  
1) Elaine Rich and Kevin Knight, Artificial Intelligence, TMH Publishers.   
2) James A Anderson, An introduction to Neural Networks.   
3) Dan. W Patterson, Artificial Intelligence and Expert

**MA 502 Simulation And ModelingC (L,T,P) = 3(3,0,0)**

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| --- | --- | --- |
| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **SYSTEM:** Definition of a system, System concepts, type of system, continuous & discrete systems, modeling process verification & validation. | **6** |
| **II** | **Probability:** Introduction of Probability Distributions and random processes, Central limit theorem. | **6** |
| **III** | **variance AND Markov chains:** Estimation of mean and variance, Confidence interval, Hypothesis testing, Normal distribution, t-test, ANOVA- an Introduction. Markov chains: CTMC and DTMC. | **8** |
| **IV** | **Queuing models:** Basic queuing models. Little’s Theorem and network of queues. Introduction, classification of simulation models, advantages and disadvantages of simulation. | **8** |
| **V** | **SIMULATION:** Concept of simulation time and real time. Discrete system simulation. Monte Carlo method, Random number generators. Simulation of inventory systems. Introduction to simulation environment and software tools. | **8** |

**References:**  
1) Principles of Operations Research, Wagner, PHI.  
2) Simulation modeling and analysis, Law and Kelton, McGraw Hill.  
3)Probability and Statistics with Reliability, Queuing and Computer Science Application, Kishore S Trivedi, Wiley.  
4) System simulation, Gorden G., Prentice Hall of India.

**MA 501 Advanced Mathematics C(L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs.36** |
| **I** | **Testing of hypothesis:** null-hypothesis, large and small samples. Chi square test- goodness of fit, independence of two variables, student t-test, f-test. | **6** |
| **II** | **Calculus of variations:**functionals, euler equations for one and several variables; isoparemetric problems; applications. | **6** |
| **III** | **Statistics and probability:** probability theory, baye’s theorem, binomial, poisson and normal distributions. | **8** |
| **IV** | **Correlation and regression:** correlation and regression, coefficient of correlation, rank correlation, lines of regression. | **8** |
| **V** | **Non linear programming**: unconstrained optimization techniques:direct search method, random search method, univariate method and pattern search method. Basic idea of hooks and heaves, simplex, powell and newton methods. | **8** |

**References:**  
1)S.srao optimization theory and application, wiley eastern limited.  
2)Chandrikaprasad – advanced mathematics for engineers.  
3) B.S.grewal-higher engineering mathematics  
4) Gokhroo and Mehta- Advanced Engineering Maths. Unique Books-Ajmer

**ME 521 MODELLING AND PLANNING OF ENERGY SYSTEMSC (L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction:** Energy policy analysis; need for energy modeling; classification of energy models; types of computer based tools for energy planning; national and rural energy planning; sect oral energy planning. | **6** |
| **II** | **Input-Output Models:** Types and Characteristics of I-O models; use of I-O models; I-O transaction tables; method of estimation and sources of data; mathematical expression on the methodology of construction of I-O tables; case studies. | **6** |
| **III** | **Econometric Models:** Statistical estimation techniques; time series; regression analysis; advantages and limitations of econometric models; elastic ties of energy demand; case studies. | **8** |
| **IV** | **Optimization Models:** Linear and non-linear optimization models; advantage and limitation of optimization models; case studies of linear optimization models for national and rural energy planning.  **Process Analysis Models:** End-use models; process analysis models for industrial, domestic and transport energy conservation; advantage and limitations of process analysis models; case studies. | **8** |
| **V** | **System Dynamic and Other Simulation Models:** Concept of closed system; causal loop diagram; flow diagram and system equations; dynamic behavior of energy systems; advantages and limitations of simulation models; case studies. | **8** |

**References:**

1) Richard de Nenfville, “ Applied Systems Analysis” MGH International Eds. 1990.

2) J.P. Weyant& T. A. Kuczmowski “Engineering- Economy Modeling: Energy Systems” Energy-The International Issue (Special issue an energy modeling), Pergaman Press. Vol. 15, No. ¾ PP 145-715, 1990.

3) J. W. Forrester, “ Principle of Systems” MIT Press, 1982.

4) Rene Codoni, Hi- Chun Park, K.V. Ramani, “ Integrated Energy Planning: A Manual” Volume on policy

**ME 523 WIND ENERGY UTILISATIONC (L,T,P) = 3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Wind Characteristics:** Sources of wind, wind hazards, sitting in flat terrain, sitting in non-flat terrain, ecological indicators of site suitability, site analysis methodology. | **6** |
| **II** | **Wind Energy System:** Energy from the wind, work-energy and power, different types of rotors, over speed control, electric power generation and storage. Water pumping systems – major components – lift – transport – storage sitting and sizing. | **6** |
| **III** | **Applied Aerodynamics:** Role of aerodynamics in wind power – cross wind axis machines – wind axis machines – general momentum theory – vortex strip theory, forces and moments due to vertical wind gradient. | **8** |
| **IV** | **Towers And Systems Installation:** Specific types of tower, Tower height, Tower and systems raising, wiring, lightning protection, Installation, maintenance of other equipments. | **8** |
| **V** | **Energy Conversion And Storage:** Synchronous inverters, dc/ac inverters, battery storage, battery characteristics, battery system installation, other types of storage systems.  **Wind Energy Conversion Systems:** Specifications and characteristics of commercial water-pumping wind mills, electricity producing wind energy. Conversion systems, selection of systems-case study. Environmental aspects.  **Applications:** Potential application of wind energy conversion systems, residential applications, wind power use in agriculture. | **8** |

**REFERENCES:**1) V. Daniel Hunt, Wind Power, Van Nostrand Reinhold Company, 1981.2) Wind Energy Basics: A Guide to Small and Micro Wind Systems; PaulGipe, Chelsea Green Pub Co; April 1999.3) Recent Advances in Wind Engineering, New Age International Publishers Ltd., 1994.

**ME 525 ENERGY MANAGEMENT C(L,T,P) =3(3,0,0)**

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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Introduction to Energy Management**: Aims and approaches of auditing, types of energy audit, energy indices in residential, commercial and industrial sector, data collection. | **6** |
| **II** | **Energy in Manufacturing**: Energy and environmental analysis of products, energy consumption in manufacturing, laws of energy and materials flow. | **6** |
| **III** | **Energy in Residential Sector:** Supply of energy for rural and urban housing, fuel substitution, efficiency improvement of domestic appliances. | **8** |
| **IV** | **Instrumentation for Energy Management**: Measurement of heat flux, radiation, psychometric variables, fluid flow & velocities, data analysis. | **8** |
| **V** | **Life Cycle Analysis**: LCA of energy systems, concept of life cycle costing and its use.  **Demand Side Management**: Principles of DSM, rules and tools of DSM, fundamentals of demand response, DSM tools and practices. | **8** |

**Reference:**1) C.B. Smith, Energy Management Principles, Pergamon Press, New York, 1981.  
2) Hamies, Energy Auditing and Conservation: Methods, Measurements, Management & case study, hemishpere, Washington, 1980.  
3) DiamantR.M.,Total Energy, Pergamon Press, Oxford, 1970.

**ME 527 ENERGY CONSERVATION TECHNOLOGIES C(L,T,P) = 3(3,0,0)**

|  |  |  |
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| **UNIT** | **COURSE CONTENTS** | **Hrs. 36** |
| **I** | **Radiant Heating Equipment**: Panel of heaters - steam - water, electrical radiant heaters, tubular radiant heaters, reflectors, heat transfer, comfort conditions, reduction of heat loss, installation. | **6** |
| **II** | **Prime Movers And Generators**: Energy conversion and efficiency, steam turbines, gas turbines, diesel and gas engines, electrical motors and DG-sets. Selection, factors affecting performance, load matching, PF improvement, maintenance practice. | **6** |
| **III** | **Heat Pumps**: General principles, appropriate conditions for using heat pumps, theoretical and practical COP, refrigerants, absorption heat pump, applications of heat pumps; gas driven heat pumps.  **Heat Recuperators**: Basic concepts, liquid/liquid heat exchangers, liquid / gas and gas/liquid heat exchangers, gas / gas exchangers, heat transfer calculations and area determination.  **Heat Regenerators**: Thermal wheel - basic principle- construction - flue gas as energy source - preheating combustion air - installation, regenerative heat recovery, double-effect operation and coupling of columns.  **Heat Pipes**: Basic concepts, design of heat pipes - heat transfer rate - thermodynamic efficiency - influencing factors- wick design - heat recovery from exhaust air, classification of heat pipes, practical applications. | **8** |
| **IV** | **Heating Ventilation And Air Conditioning**: Comfortable environment, effective temperature, heating and cooling systems, reheat systems, variable air volume, dual duct system, air water system, design considerations. | **8** |
| **V** | **Cogeneration:** Application for cogeneration, types of cogeneraiton processes- topping cycle plant- bottoming cycle plant. Choice of configuration, effect of legislation-case studies. | **8** |

**REFERENCES:**

1) R.M.E. Diamant, Energy Conservation Equipment, The Architectural Press, 1984.

2)S. David Hu, Hand Book of Industrial Energy Conservation; Van Nostrand,Reinhold Pub., 1983.

3)S.C. Tripathy, Electrical Energy Utilization and Conservation, TMH, 1986.planning, Asian & Pacific Development Center, Kuala Lumpur 1

**HS201 COMMUNICATION SKILLS C(L,T,P)=3(3,0,0)**

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| --- | --- | --- |
| **Unit** | **Course Contents** | **Total Contact Hrs. 36** |
| 1 | Foundation and background of organizational behaviour, contemporary challenges-workforce diversity, cross – cultural dynamics, changing nature of managerial work, ethical issues at work, emotional intelligence in contemporary business. Perception, Personality, Learning, Motivation – Concepts and applications, individual decision making. | 7 |
| 2 | Understanding and managing group processes-interpersonal & group dynamics, Group cohesiveness, Group decision making Emotional Intelligence-concept and applications, Understanding work teams, power & politics, Empowerment, Conflict & Negotiation. | 8 |
| 3 | Purpose and process of communication; myths and realities of communication; paths of communication; oral communication; noise, barriers to communication; listening process, types of listening, deterrents to listening process, essentials of good listening; telephonic communication. | 7 |
| 4 | Non verbal communication; gestures, handshakes, gazes, smiles, hand movements, styles of working, voice modulations, body sport for interviews; business etiquettes; business dining, business manners of people of different cultures, managing customer care. | 7 |
| 5 | Written communication; mechanics of writing, report writing, circulars, notices, memos, agenda and minutes; business correspondence-business letter format, style of letter arrangement, types of letters, telex managers, facsimiles, electronic mail; diary writing; development resume. | 7 |

**Reference Books:**

1. Enrich your English – by CIEFL (Academic Skills book)
2. Contemporary English Grammar – Raymond Murphy
3. Organizational Behavior, - Fred Luthans9thEdition, McGraw-Hill Irwin, 2002.
4. Organizational Behavior, Tenth Edition, TMG, 1998.John W. Newstorm and Keith Davis
5. . Business Communication Today – By Bovee, Thill, Schazman
6. G. Business Communication – by Pal and Korlahalli

HS202 **CONGNITIVE SKILLS (L,T,P)=3(3,0,0)**

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| **Units** | **Contents of the Subject** | **Hours** |
| 1 | Introduction to Mindfulness, Mindfulness Exercise, DBT Life Skills – Distress Tolerance | 8 |
| 2 | Mindfulness Exercise, DBT Life Skills – Emotion Regulation | 8 |
| 3 | Mindfulness Exercise, DBT Life Skills – Interpersonal Effectiveness | 7 |
| 4 | Mindfulness Exercise, Anxiety Disorders, Depression, and Personality Disorders, Acceptance: Living in the Here-and-Now as a Way of Life | 7 |
| 5 | Mindfulness Exercise, Introduction to Dialectical Behavior Therapy (DBT), Dialectic Philosophy, Wise Mind | 7 |
|  | Total | 37 |

**Reference Books:**1. Shivani D.R. (1998): NGO Development Initiative & Policy – Vikas Publications

HS 301**VERBAL& NON-VERBAL REASONING C(L,T,P)=3(3,0,0)**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Total Contact Hrs.** |
| 1 | [Logical Sequence of Words](http://www.indiabix.com/verbal-reasoning/logical-sequence-of-words/), [Blood Relation Test](http://www.indiabix.com/verbal-reasoning/blood-relation-test/), [Syllogism](http://www.indiabix.com/verbal-reasoning/syllogism/) | 7 |
| 2 | [Series Completion](http://www.indiabix.com/verbal-reasoning/series-completion/), [Cause and Effect](http://www.indiabix.com/verbal-reasoning/cause-and-effect/), [Dice](http://www.indiabix.com/verbal-reasoning/dice/) | 7 |
| 3 | [Venn Diagrams](http://www.indiabix.com/verbal-reasoning/venn-diagrams/), [Cube and Cuboids](http://www.indiabix.com/verbal-reasoning/cube-and-cuboid/)[Analogy](http://www.indiabix.com/verbal-reasoning/analogy/) | 7 |
| 4 | [Seating Arrangement](http://www.indiabix.com/verbal-reasoning/seating-arrangement/), [Character Puzzles](http://www.indiabix.com/verbal-reasoning/character-puzzles/), [Direction Sense Test](http://www.indiabix.com/verbal-reasoning/direction-sense-test/) | 7 |
| 5 | [Classification](http://www.indiabix.com/verbal-reasoning/classification/), [Data Sufficiency](http://www.indiabix.com/verbal-reasoning/data-sufficiency/), [Arithmetic Reasoning](http://www.indiabix.com/verbal-reasoning/arithmetic-reasoning/), [Verification of Truth](http://www.indiabix.com/verbal-reasoning/verification-of-truth/) | 7 |
|  | Total | 35 |

**Reference Books:**

‘Reasoning’ by R.S. Aggarwal

HS302 **EMPLOYABILITY SKILLS–IV: TECHNICAL WRITING C(L,T,P) = 4(3,1,0)**

|  |  |  |
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| **Units** | **Course Contents** | **Total Contact Hrs.** |
| 1 | Writing Process- Intro of various types of writings, Gathering, Writing, Reviewing, Editing, Indexing, Testing | 7 |
| 2 | Review Writing- Internal, Friendly and Anonymous reviews, Quantity review, Quality review, Precis Wring, Paragraph Writing, Report Writing- Science and research reports, business Reports, Business Report, Business overview | 7 |
| 3 | Letter Writing- Letter of Inquiry, Letter of adjustment, Claim Letter and follow of Letter, Letter of acceptance, Letter of refusal | 7 |
| 4 | Job search correspondence- cover letter, CV and resume | 7 |
| 5 | Writing Mails- User Guides, Reference Guide, Online helps, Website, Technical Proposal Writing. | 7 |
|  | Total | 35 |

**HS 401 TECHNICAL APTITUDE C(LTP)=3(3,0,0)**

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| **Units** | **Course Contents** | **Total Contact Hrs.** |
| 1 | PPL (Principal of Programming Language, C, C++, Java, Asp.net, DSA | 7 |
| 2 | DBMS, RDBMS | 7 |
| 3 | Networking & Related topics | 8 |
| 4 | Software Engineering and Related topics | 7 |
| 5 | Operating System (Windows, Linux, MS office) | 7 |
|  | Total | 36 |

**Reference Books:**

MCQs in Computer Science by Timothy Williams, TMH

HS 501 SOFT SKILLS TRAININIG I **C (L, T, P) = 4 (1,0,3)**

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| --- | --- | --- |
| **Unit** | **Course Contents** | **Hours** |
| I | Spoken English – PICTURE (p=pronunciation, I=inflection, C=Clarity & courtesy, T=Tone, U=Understanding and feedback, R=Rate of speech and Repeatition, E=Emphasis), Body Language Training, Active Listening | 8 |
| **II** | Introduction to business terms, Economic Times Reading, Communication skills | 8 |
| **III** | Johari Window Training, Firo-B Training, Relationship Management | 10 |
| **IV** | Role Plays, Conflict Management | 7 |
| **V** | I’m OK U’r OK Training, Time Management Training | 6 |
|  | **Total** | 39 |

HS 502 SOFT SKILLS TRAININIG I I **(L, T, P) = 4 (1,0,3)**

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| **Unit** | **Course Contents** | **Hours** |
| I | Making impact making business presentations | 6 |
| **II** | Team Management and Collaborative Work Culture | 8 |
| **III** | Training in Anchoring and Public Speaking | 6 |
| **IV** | Emotional Intelligence Training | 7 |
| **V** | Business Games, Business Etiquettes | 10 |
|  | **Total** | 37 |

HS 601 SOFT SKILLS TRAININIG III  **C (L, T, P) = 4 (1,0,3)**

|  |  |  |
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| **Unit** | **Course Contents** | **Hours** |
| I | Group Discussion Training | 6 |
| **II** | Interview Training | 8 |
| **III** | Public Relations Management, Press Relations Management | 10 |
| **IV** | Conference and Seminar Management, Event management | 7 |
| **V** | Persuasion and Negotiation Skills | 6 |
|  | **Total** | 37 |