Panjab University

Scheme and Syllabus of

Bachelor of Engineering (Electrical & Electronics Engg.)
Third-Eighth Semesters Examinations,
2019-20

VISION OF DEPARTMENT

To impart knowledge of Electrical and Electronics Engineering and prepare graduates to achieve excellence in engineering education and research.

MISSION OF DEPARTMENT

- To prepare students with deep understanding of fundamentals of Electrical and Electronics Engineering.
- To prepare professionals with positive attitude, values and vision.
- To collaborate with industry, research organizations and academia to encourage innovation.
- To provide a platform for engineering graduates to create and design new products and systems that can help industry and society as a whole.

PROGRAMME EDUCATIONAL OBJECTIVES

- Graduates will have knowledge of electrical and electronics engineering to solve problems of social relevance, pursue higher education and research.
- Graduates will undertake complex problems and develop appropriate solutions.
- Graduates will work effectively as individuals and as team members in multidisciplinary projects.

PROGRAMME OUTCOMES

1. Graduates will have an ability to apply knowledge of mathematics, science and engineering in all aspects of electrical and electronics engineering.
2. Graduates will have an ability to identify, formulate and solve electrical and electronics engineering problems.
3. Graduates will have ability to design/ develop components and processes which meet needs of society rationally.
4. Graduates will have an ability to apply theoretical knowledge of electrical and electronics engineering and to conduct experiments with electrical systems, analyze and interpret data for conclusions.
5. Graduates will have ability to model real life problems using software and hardware platforms both offline and in real time.
6. Graduates will have ability to design and construct a system, component or process to meet desired needs within realistic constraints.
7. Graduates will possesses leadership and managerial skills with professional ethical practices and social concerns.
8. Graduates will demonstrate an ability to visualize and work as individual or leader in multidisciplinary tasks.
9. Graduates will be able to communicate effectively in both verbal and written form.
10. Graduate will show understanding of impact of engineering solutions on society and also will be aware of contemporary issues.
11. Graduates will have ability to align to and upgrade to higher learning and research.
12. Graduate will have ability to participate and succeed in competitive examinations like GATE, GRE.

EXISTING REGULATIONS FOR FOUR YEAR B.E. and FIVE YEAR INTEGRATED B.E.- M.B.A. COURSES BEING OFFERED UNDER PANJAB UNIVERSITY IN THE UNIVERSITY INSTITUTE OF CHEMICAL ENGINEERING & TECHNOLOGY, PANJABUNIVERSITY, CHANDIGARH; UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY, PANJAB UNIVERSITY, CHANDIGARH; SWAMI SARVANAND GIRI PANJAB UNIVERSITY REGIONAL CENTRE, BAJWARA, HOSHIARPUR; AND CHANDIGARH COLLEGE OF ENGG. & TECH., CHANDIGARH w.e.f. THE SESSION 2010-11	MODIFIED REGULATIONS FOR FOUR YEAR B.E. and FIVE YEAR INTEGRATED B.E.- M.B.A. COURSES BEING OFFERED UNDER PANJAB UNIVERSITY IN THE UNIVERSITY INSTITUTE OF CHEMICAL ENGINEERING & TECHNOLOGY, PANJABUNIVERSITY, CHANDIGARH; UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY, PANJAB UNIVERSITY, CHANDIGARH; SWAMI SARVANAND GIRI PANJAB UNIVERSITY REGIONAL CENTRE, BAJWARA, HOSHIARPUR; AND CHANDIGARH COLLEGE OF ENGG. & TECH., CHANDIGARH w.e.f. THE SESSION 2010-11.
Approved Regulations 1. General: 1.1 The duration of the course of instruction for Bachelor of Engineering in all disciplines being offered by the Panjab University, shall be Four years (comprising of eight semesters, with two semesters per year). Each semester shall be at least of fourteen weeks duration. 1.2 The duration of the course of instruction for Integrated B.E.- M.B.A. in all disciplines being offered by the Panjab University shall be Five years. The teaching period will be divided in ten semesters. Each semester shall be at least of fourteen weeks duration. 1.3 The subjects to be studied in each semester will be as per the prescribed scheme of study for a particular course, indicating the minimum number of lectures to be delivered, distribution of marks in Major examination (End Semester Examination), Internal Assessment including two Minor Examinations(Mid semester examinations) (Minor-I, Minor-II) etc. Each subject shall have specified number of credits associated with it. The medium of instruction and examination shall be English. 1.4 The mode of admission to the First Semester course in any branch will be decided by the Syndicate. It will be open to a candidate, who has passed 10+2 examination of the Central Board of Secondary Education, New Delhi or its equivalent with Physics and Mathematics as compulsory subjects along with one of the following subjects : Chemistry, Biotechnology, Computer Science or Biology. 1.5 Provided that a candidate must have obtained a minimum of 60% marks in the qualifying examination i.e. +2 for admission to the first year B.E. and Integrated B.E. M.B.A courses in all the University Engineering Departments and Colleges affiliated to it except in the case of SC/ST/Physically Handicapped categories for which the percentage shall be 55% for admission to Engineering courses. The candidates shall be admitted on the basis of AIEEE merit conducted by CBSE. 1.6 The mode of admission to the Second year B.E Programme (lateral entry) where ever applicable will be decided by the Syndicate from time to time. It will be open to a candidate who has passed 3 year Diploma from the recognised State Board of Technical Education in India with 60% marks in the aggregate. The admission will only be made in the corresponding or equivalent branches of degree courses. Admission to various affiliated colleges and Swami Sarvanand Giri P.U. Regional Centre, Bajwara, Hoshiarpur will be made on the basis of merit obtained in the Entrance Examination to be conducted by the Panjab University. 1.7 1st, 3rd, 5th, 7th and 9th end semester examinations (major examinations) will usually be held in the month of November/December and 2nd, 4th, 6th, 8th and 10th end semester examinations (major examinations) will be held in the month of May/June every year or on such other dates as may be fixed by the Syndicate. Besides, for improvement of "E" Grade only, examination for such candidates shall be conducted within one month of the last end semester examination in which the candidate had secured ' E ' Grade in a particular subject. 1.8 There shall be at least ten lectures/tutorials/Practical /drawing classes during the semester, for every hour of lecture/tutorial/practical per week i.e for each credit assigned to a subject shown in the schedule of teaching.	**Modification Proposed** 1. General: 1.1 The duration of the course of instruction for Bachelor of Engineering in all disciplines being offered by the Panjab University, shall be Four years (comprising of eight semesters, with two semesters per year). Each semester shall be at least of fourteen weeks duration. 1.2 The duration of the course of instruction for Integrated B.E.- M.B.A. in all disciplines being offered by the Panjab University shall be Five years. The teaching period will be divided in ten semesters. 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1.9 A student shall be eligible to appear in the examination only if he/she has attended at least 75% of the total classes held as mentioned above during the semester. The attendance shall be certified by the Chairperson of the University Department(s)/institutes/Director of Institute/Principal of College as the case may be.	each credit assigned to a subject shown in the schedule of teaching. 1.9 A student shall be eligible to appear in the examination only if he/she has attended at least 75% of the total classes held as mentioned above during the semester. The attendance shall be certified by the Chairperson of the University Department(s)/institutes/Director of Institute/Principal of College as the case may be.
1.10 On the recommendations of the Chairperson of the University Department(s)/institutes/Director of Institute/Principal of College as the case may be, Board of Control will have the power to condone the shortage of the attendance up to 10% per subject only as per the merit of each case.	1.10 On the recommendations of the Chairperson of the University Department(s)/institutes/Director of Institute/Principal of College as the case may be, Board of Control will have the power to condone the shortage of the attendance up to 10% per subject only as per the merit of each case.
1.11 A candidate who does not full fill the attendance requirements in any subject will have to repeat the course of instruction in that subject.	1.11 A candidate who does not full fill the attendance requirements in any subject will have to repeat the course of instruction in that subject.
1.12 A candidate will be promoted to second year only if he has earned at least 27 credits in first year (12 credits in first semester and 15 credits in second semester) with a minimum CGPA of 5.0. Subsequently , candidate need to earn at least 30 credits every year (15 credits in each subsequent semester)with a minimum CGPA of 5.0 (5.5 in case of five year integrated B.E-M.B.A program) to get promoted to next subsequent year.	1.12 A candidate will be promoted to next year only if he has earned 50 % of the total credits of preceeding years. It means that for promotion to 2nd year, candidate should have earned 50% of the total credits of Ist year. For promotion to 3rd year a candidate should have earned 50% of the total credits of Ist and 2nd year and so on.
1.13 A candidate will be required to pass in all the subject as per the scheme of study of B.E./B.E- (MBA) course, where minimum pass grade/satisfactory completion is prescribed in a maximum duration of 6 / $7\frac{1}{2}$ academic years respectively counted from academic session in which candidate is first admitted in B.E./ B.E.-MBA program. If a candidate fails to pass the examination in the period of 6 / $7\frac{1}{2}$ academic years B.E/B.E-M.B.A, his/ her candidature will stand automatically cancelled. This period of 6 / $7\frac{1}{2}$ academic years will also include the entire period of duration which he/she had suspended his/her studies on his/her own or has failed in the examination or debarred by the Panjab University from taking any examination.	1.13 A candidate will be required to pass in all the subject as per the scheme of study of B.E./B.E- (MBA) course, where minimum pass grade/satisfactory completion is prescribed, in a maximum duration of 6/$7\frac{1}{2}$ academic years respectively counted from academic session in which candidate is first admitted in B.E./ B.E.-MBA program. If a candidate fails to pass the examination in the period of 6 / $7\frac{1}{2}$ academic years B.E/B.E-M.B.A, his/ her candidature will stand automatically cancelled. This period of 6 / $7\frac{1}{2}$ academic years will also include the entire period of duration which he/she had suspended his/her studies on his/her own or has failed in the examination or debarred by the Panjab University from taking any examination.
1.14 If an error is detected in the grades despite every possible care having been exercised, the teacher-in-charge will bring the fact to the notice of the Chairperson of University Department(s)/Director of Institute/Principal of College as the case may be for its being placed before the competent authority appointed for the purpose by the university like Board of Control or equivalent. If the Board of Control approves the change, then revised grades shall be submitted to the University duly countersigned by the members of the Board of Control and Chairperson of University Department(s)/Director of Institute/Principal of College as the case may be for consideration within a maximum period of seven working days from the date of declaration of the result.	1.14 If an error is detected in the grades despite every possible care having been exercised, the teacher-in-charge will bring the fact to the notice of the Chairperson of University Department(s)/Director of Institute/Principal of College as the case may be for its being placed before the competent authority appointed for the purpose by the university like Board of Control or equivalent. If the Board of Control approves the change, then revised grades shall be submitted to the University duly countersigned by the members of the Board of Control and Chairperson of University Department(s)/Director of Institute/Principal of College as the case may be for consideration within a maximum period of seven working days from the date of declaration of the result.
1.15 In case of any grievance, the student can always represent before the Board of Control.	1.15 In case of any grievance, the student can always represent before the Board of Control.
1.16 A detailed grade card will be issued to each student for each semester. A candidate will be awarded the degree of B.E (Bachelor of Engineering) or integrated B.E-M.B.A in respective discipline on earning minimum number of prescribed credits (corresponding to core + electives (departmental + open) + other allied subjects as prescribed in the scheme of study. The minimum C.G.P.A of 5.0 is required to qualify for the award of B E degree. In case of 5 year of integrated B.E-M.B.A program a minimum C.G.P.A of 5.5 is required to qualify for the award of integrated B.E-M.B.A degree.	1.16 A detailed grade card will be issued to each student for each semester. A candidate will be awarded the degree of B.E (Bachelor of Engineering) or integrated B.E-M.B.A in respective discipline on earning total credits (corresponding to core + electives (departmental + open) + other allied subjects) as prescribed in the scheme of study.
1.17 A candidate with CGPA of 8.5 and above will be awarded B.E /B.E-M.B.A degree with honours.	1.17 A candidate with CGPA of 8.0 and above will be awarded B.E /B.E-M.B.A degree with honours provided that the candidate has passed all papers in first attempt.
1.18 Fee for appearing in each semester examination will be as prescribed by the Syndicate/Senate from time to time. Any candidate who is required to improve upon " E" grade after each End term examination shall have to pay required re-examination fee as prescribed by the Syndicate/Senate from time to time. Any student who obtains " F" grade in a subject will have to repeat the subject subsequently and registration/ admission fee shall have to be paid by the candidate as prescribed by the Syndicate/	1.18 Fee for appearing in each semester examination will be as prescribed by the Syndicate/Senate from time to time. A candidate on reappear shall pay admission fee as prescribed by the Syndicate/Senate from time to time.

Senate.

2.0 Credit System :

2.1 All B.E / integrated B.E-M.B.A programmes are organised around semester-based credit system of study. The credit system is based on continuous evaluation of a student's performance/progress and includes flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience ,subject to fulfilling minimum requirements for continuation.

2.2 Performance/progress of a student is measured by the number of credits that he/she has earned (completed satisfactorily). Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the programme. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree.

2.3 Course Credit Assignment:

Each course has a certain number of credits assigned to it depending on the associated number of lecture , tutorials and laboratory contact hours in a week. A few courses are without credit and are referred to as non-credit (NC) courses.

Lectures and Tutorials : One lecture hour or one tutorial hour per week per semester is assigned one credit.

Practical / Laboratory Work : One laboratory hour per week per semester is assigned half credit.

The credits are rounded off to the nearest whole number

For each lecture or tutorial the self study component is 1 hour/week.

2.4 Earning Credits :

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade (at least 'D' grade), the student accumulates the course credits as earned credits. Performance of a student is measured by the number of credits that he/she has earned and by the weighted grade point average. A student has the option of auditing some courses. Grades obtained in these audit courses are not counted towards the calculation of grade point average. However, a pass grade ('D' grade) is essential for earning credits from an audit course.

3.0 Grading System :

3.1 Relative standing of the student in the class shall be clearly indicated by his/her grades. The process of awarding grades shall be based upon fitting performance of the class to a defined statistical model.

3.2 The grades and their respective description , along with grade points are listed in the table given below in Table-1

Table-1

Grade	Grade Point	Description
A+	**10**	**Outstanding**
A	**9**	**Excellent**
B+	**8**	**Very Good**
B	**7**	**Good**
C+	**6**	**Average**
C	**5**	**Below average**
D	**4**	**Marginal**
E	**2**	**Poor**
F	**0**	**Very Poor**
I	-	**Incomplete**
NP	-	**Audit Pass**
NF	-	**Audit Fail**

2.0 Credit System :

2.1 All B.E / integrated B.E-M.B.A programmes are organised around semester-based credit system of study. The credit system is based on continuous evaluation of a student's performance/progress and includes flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation.

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F	**0**	**Very Poor**
I	-	**Incomplete**
NP	-	**Audit Pass**
NF	-	**Audit Fail**
W	-	**Withdrawal**
X	-	**Unsatisfactory**
S	-	**Satisfactory Completion**

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X	-	**Unsatisfactory**
S	-	**Satisfactory Completion**
Z	-	**Course continuation**

3.3 Description of Grades **:**

A+ Grade : An A+ Grade stands for outstanding achievement. Under any circumstances A+ grade shall not be awarded for percentage of marks less than 80. There will not be more than 10% A+ grade in any course.

D Grade : The D Grade stands for marginal performance . It is the minimum passing grade in any course. D grade shall not be awarded for percentage of marks less than 35 in any case. Still further, no student having 40 percent or more marks would be awarded failing grades of E and F.

E and F Grades : The E and F Grades denote poor and very poor performance i.e failing the course. F grade is also awarded in case of poor class / lab attendance (< 75%). A student has to repeat all the core courses in which he/she has obtained E or F grade., until a passing grade is obtained. In case of optional courses (Elective courses) the candidate may take the same course or some other course from the same category. An E grade in a course makes a student eligible to repeat the course in the summer/winter semester i.e the time period between the last end term examination and the start of next semester. Further, E and F grades secured in any course stay permanently on the grade card. These grades are not counted in the calculation of CGPA ; however , these are counted in the calculation of SGPA.

I Grade: An I grade denotes incomplete performance in any L(lecture), P (practical) , V(special module) category courses. It may be awarded to a student if he/she has not fulfilled all the requirements of the course due to some extra-ordinary circumstances. I grade does not appear permanently in the grade card. Upon completion of all course requirements, the I grade is converted to regular grade (A to F , NP or NF)

NP and NF Grades : These grades are awarded in a course that the student opts to audit. Audit pass grade (NP) is awarded if the student's attendance is above 75% in the class and has obtained at least D grade. If either of these requirements is not fulfilled , audit fail (NF) grade is awarded. The grades obtained in an audit course are not considered in the calculation of SGPA or CGPA.

W Grade : A W grade is awarded in a course where the student has opted to withdraw from the course. Withdrawal from the course is permitted until one week after the first minor test.

X Grade : The X grade is awarded for incomplete\ unsatisfactory work in independent study like thesis work, project work, field work , industrial training etc.

S Grade : The S grade is awarded for complete\ satisfactory work in independent study like thesis work , project work, field work, industrial training etc.
The overall distribution of number of different grades shall be according to the statistical distribution (Normal distribution).

4.0 Evaluation System:

4.1 Continuous Assessment **:**

There shall be continuous evaluation of the student during the semester. For evaluation purpose, total marks assigned to each subject shall be distributed as :

Two Mid semester Examination (Minor-1 and Minor-2) with 30 % of total marks assigned to the subject.

Assignments/Class projects/ short class tests/MCQ based quizzes/projects/presentations/group discussions with 20 % of total marks assigned to the subject.

3.2 Description of Grades **:**

A+ Grade : An A+ Grade stands for outstanding achievement.

D Grade : The D grade stands for marginal performance . It is the minimum passing grade in any course. Still further, no student having 40 percent or more marks would be awarded failing grades of F.

F Grade : The F grade denote very poor performance i.e failing the course. F grade is also awarded in case of poor class / lab attendance (< 75%).

If candidate gets F grade he/she will have to reappear in subsequent University examination as well as Internal Assessment examination for that subject.

Candidate will be allowed maximum of four attempts to appear in any semester examination. Grace marks will be awarded according to Panjab University Calendar Volume-II "Regulation for Examination" 28.1A.

If a candidate does not avail any chance to appear in any examination whatever may be the reason he/she will not be allowed the relaxation in duration of four years.

I Grade : An I grade denotes incomplete performance. It may be awarded to a student if he/she has not fulfilled all the requirements of the course due to some extra-ordinary circumstances. I grade does not appear permanently in the grade card. Upon completion of all course requirements , the I grade is converted to regular grade (A to F , NP or NF)

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4.1 Continuous Assessment **:**

There shall be continuous evaluation of the student during the semester. For evaluation purpose, total marks assigned to each subject shall be distributed as :

Two Mid semester Examination (Minor-1 and Minor-2) with 30 % of total marks assigned to the subject. Best Marks of one of these two will be considered for award of sessional.

Assignments/Class projects/ short class tests/MCQ based quizzes/projects/presentations/group discussions/ Attendance with 20 % of total marks assigned to the subject.

One End Semester Examination (Major Examination) with 50 % of total marks assigned to the subject.

Total score on a scale of 100 i.e in % obtained by a student in a subject shall be hence forth referred as raw score in that subject.

Following the concept of relative grading , before assigning the letter grades , scientific normalization method shall be used to standardize the raw score.

4.2 Statistical Method for the Award of Grades:

For the award of grades in a course , all component wise evaluation shall be done in terms of marks. The components include : Midterm-1 and Midterm-2 examinations, Assignments/projects/class presentations/Attendance , and End semester examination as per regulation 4.1. After converting the marks obtained in percentage , the grades will be assigned as per the guidelines given below :

4.2.1 For less than 15 students in a course , the grades shall be awarded on the basis of cutoff in the absolute marks as shown in Table-2.

Table-2

Absolute marks in %	Grade	Absolute marks in %
91	< A+ <	100
82	< A <	90
73	< B+ <	81
64	< B <	72
55	< C+ <	63
46	< C <	54
40	< D <	45
35	< E <	39
	F <	35

4.2.2 For more than 30 students in a course, the statistical method shall be used for the award of grades. After expressing the score obtained by the students in a course in percentage (X), the class mean ($\bar{X}$) and class standard deviation (S) of the marks shall be calculated and grades shall be awarded to a student as shown in Table-3

If X is the raw score in % ; $\bar{X}$ is class mean in % and S is class standard deviation in % (based on raw score) , N is the number of students in a course , then for the course :

$$\bar{X} = \frac{Sum\ of\ all\ scores}{Number\ of\ Scores} = \frac{\sum_1^N X_i}{N}$$

$$S = \sqrt{\frac{\sum_1^N (X_i - \bar{X})^2}{N}}$$

Table-3

Lower Range of Marks(%)	Grade Assigned	Upper Range of Marks (%)
$\bar{X} + 2S$	$\leq$ A+	
$\bar{X} + 1.5S$	$\leq$ A <	$\bar{X} + 2S$
$\bar{X} + 1S$	$\leq$ B+ <	$\bar{X} + 1.5S$
$\bar{X} + 0.5S$	$\leq$ B <	$\bar{X} + 1S$
$\bar{X}$	$\leq$ C+ <	$\bar{X} + 0.5S$
$\bar{X} - 0.5S$	$\leq$ C <	$\bar{X}$
$\bar{X} - 1S$	$\leq$ D <	$\bar{X} - 0.5S$
$\bar{X} - 1.5S$	$\leq$ E <	$\bar{X} - 1S$

One End Semester Examination (Major Examination) with 50 % of total marks assigned to the subject. It is compulsory to appear in End Semester Examination and secure at least 20% marks of total End semester exam marks.

If a candidate secures less than 20% marks of total End semester exam marks, he/she will be awarded F grade.

4.2 Method for the Award of Grades:

For the award of grades in a course, all component wise evaluation shall be done in terms of marks. The components include: Midterm-1 and Midterm-2 examinations, Assignments/projects/class presentations/Attendance , and End semester examination as per regulation 4.1. After converting the marks obtained in percentage , the grades will be assigned as per the guidelines given below :

Table-2

Sr. No.	Marks	Grade	Grade Point
1.	≥ 90	A+	10
2.	≥ 80 & < 90	A	9
3.	≥70 & < 80	B+	8
4.	≥60 & < 70	B	7
5.	≥50 & < 60	C+	6
6.	≥45 & < 50	C	5
7.	≥40 & < 45	D	4
8.	<40	F	0

4.2.2 NOT REQUIRED

4.2.3 NOT REQUIRED

4.3 NOT REQUIRED

	< F <	$\bar{X} - 1.5S$	

4.2.3 In case , class student strength in a course lies between 15 and 30 , any of the above methods (given in 4.2.1 and 4.2.2) may be used for the award of grades.

4.3 Finalization of Grades:

Finalization of the grades shall be done by the Board of Control of the department/ institute or appropriate body/committee approved by the university for the purpose.
In order to maintain a normal distribution in grades, following recommendations of UGC shall be kept in view and considered as broad guidelines by the Board of Control of the department/ institute or appropriate body/committee approved by the university for the purpose.

Grade	% of Population	Remarks
A	7	Includes A+ and A
B	24	Includes B+ and B
C	38	Includes C+ and C
D	24	
F	7	

* Note : In case Board of Control of the department/ institute or appropriate body/committee approved by the university for the purpose , is convinced on broad variations in grade distribution in a class for a particular subject , B.O.C may make some minor variations in S while maintaining the grade distribution as recommended by the UGC.

5.0 Evaluation of Performance :
5.1 The performance of a student shall be evaluated in terms of two indices , viz. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA).

SGPA is the grade point average for the semester, and CGPA is the cumulative grade point average for all the completed semesters at any point in time.

The earned credits (E.C) are defined as the sum of course credits for course in which A+ to D grade has been obtained. For U.G students (B.E) , credits from courses in which NP or S grade has been obtained are also added.

Points earned in a semester =

$$\sum(Course\ Credits\ x\ Grade\ Points)\ for\ courses\ in\ which\ A+ \text{ to D grade has been obtained}$$

The SGPA is calculated on the basis of grades obtained in all courses, except audit courses and courses in which S/Z grade is awarded, registered for the particular semester.

$$SGPA = \frac{\sum_{Semester}(Course\ Credits \times Grade\ Points)\ \text{for all courses except audit and S/Z grade Courses}}{\sum_{Semester}(Course\ Credits)\ \text{except audit and S/Z grade Courses}}$$

$$SGPA = \frac{Points\ Secured\ in\ the\ Semester}{Credits\ Registered\ the\ Semester, excluding\ audit\ and\ {}^{S}/_{Z}\ grade\ courses}$$

The CGPA is calculated on the basis of all pass grades , except audit courses and courses in which S/Z grade is awarded, obtained in all completed semesters.

5.0 Evaluation of Performance :
5.1 The performance of a student shall be evaluated in terms of two indices , viz. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA).

SGPA is the grade point average for the semester, and CGPA is the cumulative grade point average for all the completed semesters at any point in time.

The earned credits (E.C) are defined as the sum of course credits for course in which A+ to D grade has been obtained. For U.G students (B.E) , credits from courses in which NP or S grade has been obtained are also added.
Points earned in a semester =

$$\sum(Course\ Credits\ x\ Grade\ Points)\ for\ courses\ in\ which\ A+ \text{ to D grade has been obtained}$$

The SGPA is calculated on the basis of grades obtained in all courses, except audit courses and courses in which S/Z grade is awarded, registered for the particular semester.

$$SGPA = \frac{\sum_{Semester}(Course\ Credits \times Grade\ Points)\ \text{for all courses except audit and S/Z grade Courses}}{\sum_{Semester}(Course\ Credits)\ \text{except audit and S/Z grade Courses}}$$

$$SGPA = \frac{Points\ Secured\ in\ the\ Semester}{Credits\ Registered\ the\ Semester, excluding\ audit\ and\ {}^{S}/_{Z}\ grade\ courses}$$

The CGPA is calculated as given below :

$$CGPA = \frac{\sum_{\text{All Semester}} (\ Course\ Credits \times Grade\ Point\ s\ )\ \text{for all courses with pass grade except audit and S / Z grade Courses}}{\sum_{\text{All Semester}} (\ Course\ Credits\ earned\ )\ \text{except audit and S / Z grade Courses}}$$

$$CGPA = \frac{\text{Cumulative points secured in all passed courses (A+ to D Grade)}}{\text{Cumulative earned credits , excluding audit and } S/Z \text{ grade courses.}}$$

5.2 NOT REQUIRED

5.2 Example for the calculation of SGPA and CGPA

Semester-I

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Course Code	Assigned Course Credits	Grade Awarded	Earned Credits	Grade Point (GP)	Points Secured
PH101	5	C+	5	6	30
AM101	4	C	4	5	20
ME101	4	A+	4	10	40
EE101	2	B+	2	8	16
CH101	4	E	0	2	08
CH102	2	S	2	-	-
Total→	21		17		114

Credits registered in the semester (= sum total of column 2) = 21
Credits registered in the semester excluding audit and S/Z grade courses =21-2= 19
Earned credits in the semester (= sum total of column 4) = 17
Earned credits in the semester excluding audit and S/Z grade courses = 17-2 = 15
Points secured in this semester (= sum total of column 6) = 114
Points secured in this semester in all passed courses (= sum total of column 6 with only A+ to D grades) = 114-08 = 106

$$SGPA = \frac{\text{Points Secured in the Semester}}{\text{Credits Registered the Semester, excluding audit and } S/Z \text{ grade courses}}$$

$$= \frac{114}{19} = \mathbf{6.000}$$

$$CGPA = \frac{\text{Cumulative points secured in all passed courses (A(+) to D Grade)}}{\text{Cumulative earned credits , excluding audit and } S/Z \text{ grade courses.}}$$

$$= \frac{106}{15} = \mathbf{7.067}$$

Semester Performance : Earned Credits (E.C) = 17 , with SGPA = 6.000
Cumulative performance : Earned Credits (E.C) = 17 , with CGPA = 7.067

Semester-II

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Course Code	Assigned Course Credits	Grade Awarded	Earned Credits	Grade Point (GP)	Points Secured

CY202	5	B+	5	8	40	
AM201	4	A	4	9	36	
ME201	4	W	-	-	-	
ME250	2	B	2	7	14	
CY201	4	C+	4	6	24	
CH201	4	A+	4	10	40	
HU201	1	S	1	-	-	
Total→	24		20		154	

Credits registered in the semester (= sum total of column 2) = 24
Credits registered in the semester excluding audit and S/Z grade courses =24-1= 23
Earned credits in the semester (= sum total of column 4) = 20
Earned credits in the semester excluding audit and S/Z grade courses = 20-1 = 19
Points secured in this semester (= sum total of column 6) = 154
Points secured in this semester in all passed courses (= sum total of column 6 with only A+ to D grades) = 154-0 = 154
Cumulative points earned in all passed courses till date (all past semesters + current semester) = 106+154 = 260
Cumulative earned credits till date (Earned credits in all past semesters + Earned Credits in the current semester) = 17 + 20 = 37

5.3 NOT REQUIRED

$$SGPA = \frac{Points\ Secured\ in\ the\ Semester}{Credits\ Registered\ the\ Semester, excluding\ audit\ and\ {}^{S}/_{Z}\ grade\ courses}$$

$$= \frac{154}{19} = 8.105$$

$$CGPA = \frac{Cumulative\ points\ secured\ in\ all\ passed\ courses\ (A+\ to\ D\ Grade)}{Cumulative\ earned\ credits\ , excluding\ audit\ and\ {}^{S}/_{Z}\ grade\ courses.}$$

$$= \frac{(106+154)}{(15+19)} = \frac{260}{34} = 7.647$$

Semester Performance : Earned Credits (E.C) = 20 , with SGPA = 8.105

Cumulative performance : Earned Credits (E.C) = 37 , with CGPA = 7.647

5.3 Degree Requirements :
For Four year B.E programmes, the requirements are :
(i) Minimum Earned credits : completion of 180 earned credits
For Five year Integrated B.E - M.B.A programmes , the requirements are:
(i) Minimum Earned credits : completion of 220 earned credits
These credits are needed to be earned under different categories as specified for each programme.
(ii) Cumulative Grade Point Average (CGPA) requirements

Under Four Year B.E program, a student must obtain Cumulative Grade Point Average (CGPA) of 5.0 to be eligible for award of B.E degree.
Under Five year B.E-M.B.A integrated program, a student must obtain a Cumulative Grade Point Average (CGPA) of 5.5

(iii) Practical training

A student of B.E and Integrated B.E-M.B.A programs must complete the prescribed number of days of practical training (Industrial Training or any other training as prescribed under the program) to the satisfaction of concerned department. This training will normally be arranged in the summer vacation following 6th semester. Practical training is of six weeks duration. Practical training should be carried out preferably in industry or R & D institutions in India. Practical training in academic institutions is not allowed.

(iv) NCC/NSS : All first year students are required to enrol for either NCC or NSS.

5.4 NOT REQUIRED

5.4 Degree requirements for Under Graduate programmes (Four year B.E program)

Category	Credits
UG (Core) :	**144**

Departmental Core : 80 (Min)

Basic Sciences : 20 (Min)

Engineering Art and Sciences :20 (Min)

Humanities and Social sciences : 1

UG (Elective) : 36

Departmental Elective : 12 (min)

Humanities, Social Sciences and Mgt: 08

Open category : 10 (min)

5.5 Degree requirements for Five year Integrated B.E-M.B.A programm

Category Credits

UG (Core) + PG(Core) : 140 + 36 , Total = 176

Departmental Core : 98 (Min)
Basic Sciences : 24 (Min)
Engineering Art and Sciences : 24 (Min)
Humanities and Social sciences : 1

UG (Elective) + PG (Elective) : 35+09 , Total = 44
Departmental Elective : 15 (min)
Humanities, Social Sciences and Mgt: 10
Open category : 12 (min)

5.5 Total Requirement : for four year B.E programm, sucessful completion of atleast 180 credits (UG (Core) + UG (Elective)) with minimum C.G.P.A of 5.0

Total Requirement : for five year integrated B.E-M.B.A programm, sucessful completion of atleast 220 credits ((UG +PG) (Core) + (UG+PG) (Elective)) with minimum C.G.P.A of 5.5

5.6 Maximum permissible number of registered semesters for completing all degree requirements are:

For 4-year B.E degree programmes : 12 registered semesters

For 5 –year Integrated B.E-M.B.A degree programmes : 15 registered semesters.

5.7 Conditions for termination of registration
For students admitted through AIEEE

If the performance at the end of first two registered semesters is very poor, then the registration will be terminated. If the performance is poor but not very poor , then the student can opt to start afresh, or else his/her registration will be terminated. The criteria for " very poor" and " poor" performance are :

Performance	Earned Credits	Decision
Very poor	<= 15 for GE/OBC;<= 11 for SC/ST/PH	Termination of registration
Poor	16 to 26 for GE/OBC; 12-22 for SC/ST/PH	Restart (once only) or Termination of registation

(i) If a student chooses to restart after first two registered semesters, then his or her credits earned and semesters registered will not be carried over.

5.5 NOT REQUIRED

5.6 NOT REQUIRED

5.7 NOT REQUIRED

Note:

1. Paper setting for End term examination (Major Examination or End semester examination) shall continue to be as per the proceedure in place at present till any further modification is introduced.
2. There shall be no " special reappear examination"
3. Subject wise result in the form of grades awarded to each student at the end of each semester shall be prepared by the respective departments/institutes/college/center and sent to the university examination branch for the declaration of result and issuance of grade cards.

The re-start will be indicated on the transcript. The restart will be permitted only once. If at the end of two registered semesters after re-start , the earned credits are <= 26 for GE/OBC or <= 22 for SC/ST/PH students , then the registration will be terminated.

(ii) Each student is expected to earn atleast 12 credits in the first registered semester and 15 credits in each subsequent registered semesters with SGPA >= 5.0 . If the performance of a student at the end of any registered semester is below this minimum acceptable level , then he/she will be placed on probation and a warning shall be issued to him/her and parents shall also be informed accordingly.

(iii) The student placed on probation shall be monitored, including mandatory class attendance , special tutorials and mentoring. Mentoring shall include specific guidance under a faculty member /PG student.

(iv) The registration of any student will be limited to 1.5 times the average earned credits of the previous two registered semesters, subject to a minimum of 15 credits and a maximum of 26 credits.

Note:

1. Paper setting for End term examination (Major Examination or End semester examination) shall continue to be as per the proceedure in place at present till any further modification is introduced.
2. There shall be no " special reappear examination"
3. Subject wise result in the form of grades awarded to each student at the end of each semester shall be prepared by the respective departments/institutes/college/center and and sent to the university examination branch for the declaration of result and issuance of grade cards.
4. Course teacher should display the grades awarded to the students on the notice board after showing the answer scripts to the students within five working days. The process of evaluation should invariably be completed within seven days from the date of conduct of examination.

4. Course teacher should display the grades awarded to the students on the notice board after showing the answer scripts to the students within five working days. The process of evaluation should invariably be completed within seven days from the date of conduct of examination.

Scheme of Examination and Syllabi for
B.E. (Electrical and Electronics Engineering)
3rd to 8th Semester for Academic Year 2019-2020

Year: Second **Semester: Third**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE301	Electric Machinery-I	3-1-0	4	4	50	50	100	-
2	EE351	Electric Machinery-I Lab	0-0-3	3	1	-	-	-	50
3	EE305	Network Analysis and Synthesis	3-1-0	4	4	50	50	100	-
4	EE356	Network Analysis and Synthesis Lab	0-0-3	3	1	-	-	-	50
5	EE307	Analog and Digital Electronics	3-1-0	4	4	50	50	100	-
6	EE358	Analog and Digital Electronics Lab	0-0-3	3	1	-	-	-	50
7	MATHS 301	Linear Algebra and Complex Analysis	4-1-0	5	4	50	50	100	-
8	HSS301	Elective (from Social Sciences)	3-0-0	3	3	50	50	100	-
Total			16-4-9	29	22	250	250	500	150

*Practical marks are for continuous and end semester evaluation

Year: Second **Semester: Fourth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	AS401	Numerical Analysis	4-1-0	5	4	50	50	100	-
2	EE401	Electric Machinery-II	3-1-0	4	4	50	50	100	
3	EE451	Electric Machinery-II Lab	0-0-3	3	1	-	-	-	50
4	EE402	Control Engg.	3-1-0	4	4	50	50	100	
5	EE452	Control Engg. Lab	0-0-3	3	1	-	-	-	50
6	EE403	Power Systems-I	3-1-0	4	4	50	50	100	
7	EE453	Power Systems-I Lab	0-0-3	3	1	-	-	-	50
8	EE405	Microprocessor and Interfacing	3-1-0	4	4	50	50	100	-
9	EE455	Microprocessor and Interfacing Lab	0-0-3	3	1	-	-	-	50
Total			16-5-12	33	24	250	250	500	200

*Practical marks are for continuous and end semester evaluation

Year: Third **Semester: Fifth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE-501	Power Systems-II	3-1-0	4	4	50	50	100	-
2	EE-551	Power Systems-II Lab	0-0-3	3	1	-	-	-	50
3	EE-510	Micro Controllers	3-1-0	4	4	50	50	100	-
4	EE-560	Micro Controllers Lab	0-0-3	3	1	-	-	-	50
5	EE-507	Communication Engg.	3-1-0	4	4	50	50	100	-
6	EE-557	Communication Engg. Lab	0-0-3	3	1	-	-	-	50
7	EE-508	Electromagnetic Filed Theory	3-1-0	4	4	50	50	100	-
8	EE-509	Control Engineering-II	3-1-0	4	4	50	50	100	-
9	EE-559	Control Engineering-II Lab	0-0-3	3	1	-	-	-	50
10	EE-556	Vocational Training after Fourth Semester	0-0-0	-	1	-	-	-	50
Total			15-5-12	32	25	250	250	500	250
Subjects offered by DIC (OPTIONAL)									
11	DIC-01	Principles of Design Engineering and Product Development	0-0-3	3	2	-	-	-	100

*Practical marks are for continuous and end semester evaluation

Year: Third **Semester: Sixth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE-601	Computer Aided Power Systems Analysis	3-1-0	4	4	50	50	100	-
2	EE-651	Computer Aided Power Systems Analysis Lab	0-0-3	3	1	-	-	-	50
3	EE-611	Programmable Logic Controller and Distributed Control System	3-1-0	4	4	50	50	100	-
4	EE-661	Programmable Logic Controller and Distributed Control System Lab.	0-0-3	3	1	-	-	-	50
5	EE-612	Signals and Systems	3-1-0	4	4	50	50	100	-
6	EE-613	Energy Management & auditing	3-1-0	4	4	50	50	100	-
7	EE-663	Energy Management & auditing Lab	0-0-3	3	1	-	-	-	50
8	EE-606	Power Electronics	3-1-0	4	4	50	50	100	-
9	EE-656	Power Electronics Lab	0-0-3	3	1	-	-	-	50
Total			15-5-12	32	24	250	250	500	200
Subjects offered by DIC (OPTIONAL)									
	DIC-02	Sensors based Application Systems	3-1-0	4	4	50	50	100	-

*Practical marks are for continuous and end semester evaluation

Year: Fourth **Semester: Seven**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE-710	Power Electronic and Drives	3-1-0	4	4	50	50	100	-
2	EE-760	Power Electronic and Drives Lab	0-0-3	3	1	-	-	-	50
3	EE-711	Electrical Insulation in Power Apparatus & Systems	3-1-0	4	3	50	50	100	-
4	EE708	Digital Signal Processing	3-1-0	4	4	50	50	100	-
5	EE758	Digital Signal Processing Lab	0-0-3	3	1	-	-	-	50
6	EE-709	Elective-I	3-1-0	4	4	50	50	100	-
7	EE-705	Minor Project	0-0-6	6	3	-	-	-	100
8	EE-706	Seminar	0-0-2	2	1	-	-	-	50
9	EE-707	Vocational Training of Sixth Semester	0-0-2	2	1	-	-	-	50
Total			12-4-16	32	22	200	200	400	300

*Practical marks are for continuous and end semester evaluation

Elective-I

- ***(i) Electrical Traction***
- ***(ii) Electrical Power Generation***
- ***(iii) Electrical utilization and illumination***

Year: Fourth **Semester: Eight**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE-801	Non – Conventional Energy Sources	3-1-0	4	4	50	50	100	-
2	EE-809	Wireless Communication	3-1-0	4	4	50	50	100	-
3	EE-859	Wireless Communication (Lab)	0-0-3	3	1	-	-	-	50
4	EE-808	Elective –II	3-1-0	4	4	50	50	100	-
5	EE-810	Elective –III	3-1-0	4	3	50	50	100	-
6	EE-805	Major Project	0-0-6	6	6	-	-	-	100
Total			12-4-9	25	22	200	200	400	150

*Practical marks are for continuous and end semester evaluation

A student can exercise option I and Option II according to the following:

Option-I

Elective-II

- ***(i) Electrical Machine Design***
- ***(ii) High Voltage AC-DC***
- ***(iii) FACTS***
- ***(iv) Embedded System Design***

Elective-III

- ***(i) Entrepreneurship and Project Management***
- ***(ii) Financial Management***
- ***(iii) Marketing Management***
- ***(iv) Cyber Laws and IPR***

Option II

Industrial Training EE-850 Total Marks-550

Option II							
S.No	Course Code	Course Name	Duration	Credits	Scheme of Examination		
					Practical		
					Internal Assessment	University Assessment	Total
1	EE-850	Industrial Training	6 Months	22	250	300	550

A student may opt for one semester training in lieu of subjects of 8th Semester. The marks for six months training will be equal to the total marks of 8th Semester study. A student can opt for six month training under following conditions:-

a) The student got selected for job in campus placement and the employer is willing to take that student for the training.
b) The student got offer of pursuing training from reputed government research organization/govt. sponsored projects/govt. research institution provided that student should not be paying any money to get trained. For pursuing this training student needs the prior approval from the Chairperson/Coordinator of the respective branch.

Scheme of Examination and Syllabi for
B.E. (Electrical and Electronics Engineering)
3rd to 8th Semester for Academic Year 2019-2020

Year: Second **Semester: Third**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE301	Electric Machinery-I	3-1-0	4	4	50	50	100	-
2	EE351	Electric Machinery-I Lab	0-0-3	3	1	-	-	-	50
3	EE305	Network Analysis and Synthesis	3-1-0	4	4	50	50	100	-
4	EE356	Network Analysis and Synthesis Lab	0-0-3	3	1	-	-	-	50
5	EE307	Analog and Digital Electronics	3-1-0	4	4	50	50	100	-
6	EE358	Analog and Digital Electronics Lab	0-0-3	3	1	-	-	-	50
7	MATHS 301	Linear Algebra and Complex Analysis	4-1-0	5	4	50	50	100	-
8	HSS301	Elective (from Social Sciences)	3-0-0	3	3	50	50	100	-
Total			16-4-9	29	22	250	250	500	150

*Practical marks are for continuous and end semester evaluation

Third Semester

Course Code	**EE-301**
Course Title	**Electric Machinery-I**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Basic Electrical Engineering
Course Objectives (CO)	1. To understand the working and constructional features of transformer and Electric machines. 2. To understand the process to test, control and analyze the performances various electric machines. 3. To understand the applications of transformer and electric machines in the field.
Course Outcome	1. To apply test procedures for performance analysis of various machines. 2. Identification and selection of machine for a specific application. 3. To apply starting and speed control techniques on various machines. 4. Performance analysis of machine on the basis of operational characteristics.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Transformers

Construction of transformer, Ideal transformer: Transformer polarity, Transformer ratings, Non-ideal transformer: Winding resistances, Leakage fluxes, Finite permeability, Phasor diagram, Equivalent circuit, Voltage regulation, Maximum efficiency criterion, Determination of transformer parameters: Open circuit and short circuit tests, Per unit computations, Autotransformer, Three-phase transformer: Y/Y, Delta/delta, Y/delta, Delta/Y connections, Analysis of three-phase transformer. Constant current transformers, Instrument Transformers: Current transformer, Potential transformer.

(11 hours)

Direct Current Machines

Generators: Mechanical construction, Armature windings, Induced emf equation, Developed torque, Magnetization characteristics, Theory of commutation, Armature reaction, Types of d.c. generators, Voltage regulation, Losses, Separately excited, shunt, series and compound generators and characteristics, Maximum efficiency criterion.

Motors: Operation, Speed regulation, Losses, Series, shunt and compound motors, methods of speed control, Ward Leonard method, Braking or Reversing d.c. motors.

(12 hours)

SECTION-B

Polyphase Induction Machines

Induction Motor: Construction**,** Principle of operation, Equivalent circuit, Power relations, Speed torque characteristics. Maximum power criterion, Maximum torque criterion and maximum efficiency criterion, Blocked rotor test, No-load test, Load test. Starting of induction motor, Rotor impedance transformation, Speed Control Methods: Frequency control, Changing stator poles, Rotor resistance control, Stator voltage control, Injecting an EMF in the rotor circuit.

Induction Generator: Motor to generator transition, Induction generator starting and operation with other three phase sources, isolated generator operation and voltage build up.

(12 hours)

Single Phase Induction Motors

Double revolving field theory, Analysis of single phase induction motor and speed torque characteristics, Split Phase, Capacitor start, Capacitor start capacitor run motor, Permanent split capacitor motor, Shaded pole motor, Testing of single phase induction motor: No load and block rotor tests. [Guru-Hiziroglu:10.1-10.4, 10.6-10.7]

(10 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Electric Machinery and Transformers	B.S.Guru and H.R. Hiziroglu	3rd edition, Oxford, 2001.
2	Electric Machines	Charles I. Hubert	2nd edition, Pearson, 2002
RECOMMENDED BOOKS			
1	Electric Machinery	A.E. Fitzgerald, C. Kingsley & D. S. Umans	6th edition, McGraw-Hill, 2003.
2	Electrical Machines	S. Ghosh	1st edition, Pearson, 2005
3	Electrical Machinery	P.S. Bimbhra	4th edition Khanna Publishers

Course Title	Electric Machinery-I Lab		Credits	01
Course Code	EE-351	Max Marks-50	P	03

Note: At least eight experiments to be done.

1. Open circuit and short circuit test of single phase/ three phase transformer and obtain its equivalent circuit.
2. Parallel operation of two single phase transformers.
3. Back-to-back test on two single phase transformers.
4. Different winding connections of three phase two winding transformer and to identify proper combination for parallel operation.
5. Parallel operation of two three phase transformers.
6. Performance characteristic of a given dc shunt machine.
7. Performance characteristic of a given dc series machine.
8. Efficiency at different loads of the given dc shunt machine through Swinburne / load test.
9. Speed control characteristics of a given dc shunt motor by (i) Armature control (ii) Field control.
10. No load and blocked rotor test on a three phase induction motor and to obtain its Equivalent circuit
11. Torque speed characteristics of three phase induction motor.

Course Code	**EE-305**
Course Title	**Network Analysis and Synthesis**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic fundamentals and concepts of basic Electrical Engineering.**
Course Objectives (CO)	1. To provide the various Basic concepts, laws and various circuit analyzing methods applied in solving Electrical Circuits. 2. To provide the concept of three phase supply systems. 3. To understand the concept of graph theory and Laplace transform to analyze the Electrical Circuits. 4. To provide the basic knowledge of Network Functions and their stability in frequency domain. 5. To understand the concepts of stability and methods to check the stability.
Course Outcome	1. Students will understand the basic concepts, laws used in the Electrical Circuits. 2. Students will understand the procedures to solve the various Electrical Circuit problems using different methods of analysis like circuit theorems, mesh analysis, nodal analysis, Graph theory and Laplace transformation to solve the Electrical Circuit problems. 3. Students will understand the behaviour of the different networks in frequency domain and stability of networks. 4. Students will understand to synthesize networks.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Methods of analyzing A.C. Circuits

Formulation of network equations, Source transformation Nodal Analysis: Node voltages, matrix node equations, Mesh Analysis: Mesh currents, matrix mesh equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer theorem, analysis of circuits using theorems, analysis of three phase system with unbalanced load. **(8 hours)**

Network Topology

Introduction, Network Graph, Tree and Co-tree, Twigs and Links, Incidence Matrices and its properties, Link currents: Tie-Set Matrix, Cut-Set and Tree Branch Voltages, Solution of Problems. **(7 hours)**

Two-Port Networks

Introduction, Open Circuit Impedance Parameter, Short Circuit Admittance Parameter, Transmission Parameter, Inverse Transmission Parameter, Hybrid Parameter, Interrelationship of different parameters, Inter-Connection of Two-Port Networks, Terminated Two-Port Network, T and Π representation, solution of problems. **(7 hours)**

SECTION-B

Transient Analysis of Networks

Network elements, Transient response of R-L, R-C, R-L-C for DC and sinusoidal excitation, Initial condition, Solution using differential equation approach and Laplace transform method. **(7 hours)**

Network Functions

Introduction, driving point and transfer functions, poles & zeros and their significance, network functions for one port and two port networks, Properties and Necessary Conditions of Driving Point Functions and Transfer Functions, time domain behavior from the pole-zero plot. Stability check using Routh criterion, solution of problems. **(8 hours)**

Elements of Network Synthesis

Review of Network Functions, Network realizability, Hurwitz Polynomials, Positive real functions, Properties of RC, RL & LC networks, Foster and Cauer forms of realization, solution of problems.

(8 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Circuits and Systems	K.M.Soni	S.K. Kataria & Sons.
2	Circuit theory'	Dr. Abhijit Chakrabarty	Dhanpat Rai & Co Pvt. Ltd.
RECOMMENDED BOOKS			
1	Engineering Circuit Analysis'	W.H. Hayt, J.E. Kimmerely, and S. M. Durbin	6th edition, McGraw-Hill, 2002.
2	Linear Circuit Analysis	R.A. DeCarlo and P.M. Lin	2nd edition, Oxford, 2001
3	Fundamentals of Electric Circuits	Charles K. Alexander, Mathew N. O. Sadiku	2nd edition, McGrawHill, 2004.
4	Circuits and Networks Analysis and Synthesis	A. Sudhakar, Shyammohan S. Palli,	4th edition, McGrawHill, 2010
5	A Text Book of Electrical Technology Part-I	B.L. Thereja	S. Chand.
6	Fundamentals of Electrical Networks	B.R. Gupta	Wheeler.
7	Circuits & Networks	Sudhakar & Shyammohan	Tata McGraw-Hill.
8	Series of Circuit Theory	Schaum	Tata McGraw-Hill

Course Title	Network Analysis and Synthesis Lab		Credits	01
Course Code	EE-356	Max Marks-50	P	03

List of Experiments

1. Introduction to Pspice software.
2. To determine phase sequence of three phase supply system and to find the line currents for three phase three wire load when the sequence is i) RYB ii) RBY.
3. To make 3-phase unbalanced network with neutral return of known impedance. Measure phase currents, neutral currents and the potential difference between the load and supply neutral.
4. Measurement of 3-phase power by two watt meter method for unbalanced loads.
5. To check the polarity marking of a transformer and to determine self inductance of each winding and mutual inductance between the windings.
6. Find impedance, admittance, transmission and hybrid parameters of the two port network.
7. Simulation of dc circuits using Pspice.
8. DC Transient response using Pspice.
9. Mesh analysis using Pspice.
10. Nodal analysis Pspice.

Course Code	**EE-307**
Course Title	**Analog and Digital Electronics**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Basic Electrical Engineering
Course Objectives (CO)	1. To study the concept of transistor biasing and stability. 2. To introduce the concept of low and high frequency transistor model. 3. To study various types of feedback amplifiers and oscillators. 4. To study the concept of operational amplifiers. 5. To inculcate understanding of digital devices and data converters.
Course Outcome	1. Acquire a basic knowledge in transistor biasing and stability 2. Develop the ability to analyze and design analog electronic circuits using discrete components. 3. Apply op-amps fundamentals in design and analysis of op-amps applications 4. Identify, by inspection, the type of feedback at work in a given amplifier circuit, and estimate the feedback factor, loop gain, and the allied properties 5. Students should be able to apply the knowledge and understanding gained about digital devices to practical Projects. 6. To create a foundation for Subjects like Microprocessor and Microcontrollers
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Transistor Biasing and Stability

Transistor fundamentals, transistor configurations, , BJT characteristics & parameters, DC operating point ,biasing circuits and their analysis. Transistor hybrid model, Analysis of transistor amplifier using h-parameters in CB, CE and CC configuration. (7hours)

Feedback Amplifiers and Oscillators

Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Oscillator, Condition of oscillations,Types of oscillators and their applications (7 hours)

Differential and Operational Amplifiers

Differential amplifiers: Inverting and non-inverting inputs. Various modes of operation, Operational amplifiers (Op amps): Op amp characteristics and specifications, Inverting and non-inverting amplifiers and their analysis, Integrators and differentiators, Log amplifier, Active filters. (8 hours)

SECTION-B

Introduction

Boolean Algebra, Boolean Expressions and minimization of Boolean expression using K-Map(up to five variables), Review of Logic Gates, design & Implementation of Adder, Subtractor, Multiplexer, DeMultiplexer, Encoder, Decoder. (8 hours)

Sequential Circuits

Types of flip flop, S-R Flip-Flop, JK Flip-Flop, Race around Condition , Master Slave Flip-Flop, D&T type Flip-Flop , Shift Register and counters (7 hours)

Data Converters

Sample & Hold switch, D/A converters: weighted resistor type, R-2R Ladder type; A/D Converters: Counter-Ramp type, Dual Slope Type, Successive approximation type. (8 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Integrated Electronics,	J. Millman and C.C. Halkias	McGraw-Hill, 1972
	Op-Amps and Liner integrated Circuits	Ramakant A. Gayakward	4th edition, Pearson Education Asia Low price Edition
	T. Schilling	*Digital Electronics*	
2	*Integrated Electronics*	Millman & Halkias	Tata Mcgraw
RECOMMENDED BOOKS			
1	Electronic Devices and Circuits	Robert L. Boylestad and Louis Nashelsky	Pearson/ Prentice Hall, 9th Edition, 2006
2	Electronic Devices and Circuits	Theodore F. Bogart Jr., J.S. Beasley and G. Rico,	Pearson Edition, 6th Edition, 2004.
3	Digital System Principles & Applications	R J Tocci	PHI

Course Title	Analog and Digital Electronics Lab		Credits	01
Course Code	EE-358	Max Marks-50	P	03

At least eight experiments to be done.

1. To study the P-spice software & simulation.
2. To study the device modeling using COMSOL software
3. To draw the frequency response of a single stage BJT amplifier using P-spice.
4. To study the oscillator and determine its frequency using P-spice.
5. To study the frequency response of OP-Amp & simulate using P-spice
6. To study op amp applications and simulate using P-spice.
7. To design Butter worth Low pass filter, High pass filter & simulate using P-spice.
8. To computes the potential and carrier concentrations for a one-dimensional p-n junction using COMSOL.
9. To do the device modeling and analysis of BJT using COMSOL
10. To calculates the DC characteristics of a simple MOSFET using COMSOL.
11. To verify the truth tables of basic gates.
12. To verify NAND and NOR as universal gates.
13. To realize adder and subtractor using logic gates.
14. To design and implement SR, JK, D and T flip flops.

Course Title	Linear Algebra and Complex Analysis			Credits	04
Course Code	MATHS-301			L T P	4 1 0
Contact Hours	45	Max Marks-50	Internal Assessment-50	Elective	N
Pre-requisites	Calculus (MATHS-101)				
Course Objectives	1. To learn methods to solve system of linear equations 2. To understand the concepts of vector space, linear independence and linear transformation and their applications 3. To understand the concept of eigen values and eigen vectors of matrices and applications to engineering problems 4. To understand the concepts of functions of complex variables e.g., differentiation , integration and expansion in terms of series and applications 5. To understand the need and origin of conformal mappings				
Course Outcome(s)	1. Students will be able to apply methods to solve system of linear equations including large systems which arise in various engineering problems 2. Students are able to understand the applications of linear independence of vectors and linear transformations. 3. Students will be able to apply the concepts of eigen values, eigen vectors and diagonalization to simplify and solve engineering problems 4. Ability to differentiate, expand and integrate functions of complex variables and to use them to solve real integrals 5. Transform regions associated with engineering problems using conformal mappings to simple regions				

Note for Examiner- *Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Systems of Linear equations:

Introduction, Linear equations, solutions, Linear equations in two unknowns, Systems of linear equations, equivalent systems, Elementary operations, Systems in Triangular and echelon form, Reduction Algorithm, Matrices, Row equivalence and elementary row operations, Systems of Linear equations and matrices, Homogeneous systems of Linear equations. (Scope as in Chapter 1, Sections 1.1-1.10 of Reference 1). (5hours)

Vector Spaces:

Introduction, Vector spaces, examples of vector spaces, subspaces, Linear combinations, Linear spans, Linear dependence and Independence, Basis and Dimension, Linear equations and vector spaces. (Scope as in Chapter 5, Sections 5.1-5.8 of Reference 1). (5 hours)

Eigenvalues and Eigenvectors, Diagonalization:

Introduction, Polynomials in matrices, Characteristic polynomial, Cayley-Hamilton theorem, Eigen-values and Eigen-vectors, computing Eigen-values and Eigen-vectors, Diagonalizing matrices. (Scope as in Chapter 8, Sections 8.1-8.5 of Reference 1). (3 hours)

Linear Transformations:

Introduction, Mappings, Linear mappings, Kernal and image of a linear mapping, Rank- Nullity theorem (without proof), singular and non-singular linear mappings, isomorphisms. (Scope as in Chapter 9, Sections 9.1-9.5 of Reference 1). (5 hours)

Matrices and Linear transformations:

Introduction, Matrix representation of a linear operator, Change of basis and Linear operators. (Scope as in Chapter 10, Sections 10.1-10.3 of Reference 1). (5 hours)

SECTION-B

Complex Functions: Definition of a Complex Function, Concept of continuity and differentiability of a complex function, Cauchy – Riemann equations, necessary and sufficient conditions for differentiability (Statement only). Study of complex functions: Exponential function, Trigonometric functions, Hyperbolic functions, real and imaginary part of trigonometric and hyperbolic functions, Logarithmic functions of a complex variable, complex exponents (Scope as in Chapter 12, Sections 12.3 – 12.4, 12.6 – 12.8 of Reference 4).

(8 hours)

Laurent Series of function of complex variable, Singularities and Zeros, Residues at simple poles and Residue at a pole of any order, Residue Theorem (Statement only) and its simple applications (Scope as in Chapter 15, Sections 15.1 – 15.3 of Reference 4). (7 hours)

Conformal Mappings, Linear Fractional Transformations (Scope as in Chapter 12, Sections 12.5, 12.9 of Reference 4). (7 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Outline of Theory and Problems of Linear Algebra	Seymour Lipschutz, Shaum	Second Edition, McGraw-Hill, 1991.
2	Complex Variables and Applications	R. V. Churchill, J. W. Brown	Sixth Edition, McGraw-Hill, Singapore, 1996
3	T. Schilling	Vivek Sahai, Vikas Bist.	Narosa Publishing House, New Delhi, 2002.
4	Advanced Engineering Mathematics	E. Kreyszig.	Eighth Edition, John Wiley.
RECOMMENDED BOOKS			
1	Advanced Engineering Mathematics	Michael D. Greenberg	Second Edition, Pearson Education.

Course Code	**HSS301 (a)**
Course Title	**Economics**
Type of Course	**Elective**
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic Electronics Engineering**
Course Objectives (CO)	1. To make students understand how society manages its scarce resources for achieving maximum satisfaction. 2. To make students learn about economic aspects related to a consumer, firm, market and economy.
Course Outcome	1. The students are expected to apply engineering knowledge to maximize profit, satisfaction and welfare. 2. The students are able to identify the forces that affect the economy.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Introduction to Economics

Nature of Economics, Economic Thoughts, Economic Activities, Relationship of Economics with other Social Sciences and Engineering . (9hours)

Theory of Consumer Behaviour

Demand: Types, Law of Demand, Determinants of Demand and Change in Demand Elasticity of Demand: Nature, Degrees, Types, Measurement and Factors Affecting Elasticity of Demand and its Application

Laws of Consumption: Concept and Applicability of Law of Diminishing Marginal Utility and Law of Equi-Marginal Utility (14 hours)

SECTION-B

Theory of Market

Nature and Relevance of Perfect Competition, Monopoly and Monopolistic Competition

(11 hours)

Basic Concepts of Macro Economics
National Income: Concept and Measurement, Determination of Equilibrium of Income
Inflation: Concept, Causes and Effect of Inflation, Measures to Control Inflation.

Project Presentations (11 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Modern Economics	Ahuja H. L.	S. Chand & Co. Ltd
	Economics For Engineers	Gupta M. L. & Gupta S. P.	ESS PEE Publications
RECOMMENDED BOOKS			
1	Business Economics	Ahuja H. L.	S. Chand & Co. Ltd
2	Macro Economic Theory	Jhingan M.L.	Konark Publisher Pvt. Ltd.
3	Principles of Microeconomics	Stiglitz J. & Walsh Carl E.	W.W. Norton & Company
4	Principles of Macroeconomics	Stiglitz J. & Walsh Carl E.	W.W. Norton & Company
5	Principles of Economics	Mankiw N Gregory	Cengage Learning
6	Course in Micro Economics Theory	Kreps A	Prentice Hall
7	Economics	Samuelson Paul A. & Nordhaus William D	Tata McGraw Hill
8	Microeconomics	Gravelle H. & Reiss R	Pearson Education
9	Macro Economics: Theory and Practice	Ahuja H.	S. Chand & Co. Ltd.

Course Code	**HSS301 (b)**
Course Title	**Introduction to Psychology**
Type of Course	**Elective**
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic Electronics Engineering**
Course Objectives (CO)	1. To provide knowledge and understanding about important concepts in Psychology. 2. To make students learn the application of principles of psychology in working life.
Course Outcome	1. The students will learn the causes and dynamics of human behavior. 2. The students will be able to apply psychological principles to enhance their personal and professional life.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Understanding Human Behaviour: Definition, methods, branches and application of psychology for engineers (5hours)

Measuring Human abilities: Intelligence, theories and assessment (6 hours)

The individual working life: Personality, approaches and trait theories (6 hours)

Psychological problems of everyday life: Stress and coping (6 hours)

SECTION-B

Work and mental health, workplace spirituality (5 hours)

Motivation : the concept and theoretical framework, motivating people at work (5 hours)

Group dynamics, Intergroup relations, conflict and negotiation (7 hours)

Leadership and Management (5 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Psychology	Ciccarelli, S.K., & Meyer, G.E	Pearson, 2007.
2	Organisational Behaviour.	Parikh, M., & Gupta, R.	Tata McGraw Hill Education, 2010.
3	Introduction to Psychology	Morgan,C.T., King, R.A., Weiss, J.R., & Schopler, J.	McGraw-Hill, 1986.
4	Organizational Behavior.	Robbins, S.P.	Prentice Hall of India, 2003.
5	Organizational Behavior	Luthans,F.	McGraw Hill,2010

Course Code	**HSS301 (c)**
Course Title	**Sociology**
Type of Course	**Elective**
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic Electronics Engineering**
Course Objectives (CO)	1. To make the students understand the role of theory in social sciences. 2. To explain students how social problems interact and react with the larger society. 3. To make students learn whether the problem is evaluated on the macro or micro perspective and their cause and effect patterns.
Course Outcome	1. The students will be able to identify the function and application of sociology theory in social sciences. 2. The students will be able to understand how social class affects individual life chances. 3. The students will learn about social structure and how it shapes and influences social interactions.

SYLLABUS

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

SECTION-A

Sociology – The Discipline

Sociology as a Science, Impact of Industrial and French Revolution on the Emergence of Sociology, Relevance of Sociology for Engineering (4hours)

Basic Concepts

Society, Association, Institution, Culture Relativism, Social Structure, Social System, Socialisation, Competition, Conflict, Accommodation, Social Mobility (4 hours)

Pioneering Contributions to Sociology

Seminal Views of Karl Marx, Emile Durkheim, Max Weber, Alwin Toeffler (4 hours)

Evolution of Society

Primitive, Agrarian, Industrial and Post-Industrial, Features of Industrial and Post-Industrial (5 hours)

Economy and Society

Economic Systems of Simple and Complex Societies, Sociological Dimensions of Economic Life, Market (free) Economy and Controlled (planned) Economy (5 hours)

SECTION-B

Industrial Sociology

Nature and Scope of Industrial Sociology, Pre-Conditions and Consequences of IndustrializationWork and mental health, workplace spirituality (4 hours)

Science and Technology

Ethos of Science and Social Responsibility of ScienceMotivation : the concept and theoretical framework, motivating people at work (5 hours)

Social Change

Theories of Change, Factors of Change, Directed Social Change, Social Policy and Social Development, Social Cost Benefit Analysis, Role of Engineers in Development

Understanding Indian Society (6 hours)

Traditional Hindu Social Organization, Caste System, Agrarian Society in India, Social Consequences of Land Reforms and Green Revolution, Working of the Democratic Political System in a Traditional Society, Problem of Education in India, Gender Discrimination, Economic Reforms: Liberalization, Privatization and Globalization, Strategies for Development in India (4 hours)

Social Problems

AIDS, Alcoholism, Drug Addiction, Corruption (4 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Sociology	Vardhan Ranjay and Kapila S.	New Academic Publishing.
2	Sociology: Themes and Perspective	Haralambos M	Collins Educational Publications.
RECOMMENDED BOOKS			
1	Sociology of Indian Society	Rao Shankar C.N	Sultan Chand and Co.
2	Introduction to Sociology	Bhushan Vidya and Sachdeva D.R	Kitab Mahal Publications
3	Sociological Thought	Abraham Francis and Morgan J.H	Macmillan India Ltd.
4	An Introduction to Sociology	Dassgupta Samir and Saha Paulomi, .	Dorling Kindersley (India) Pvt. Ltd.
5	Social Change and Modern India	Srinivas M.N	Orient Longman.
6	Social Problems	Amitai Etzioni	Prentice Hall
7	Industrial Sociology	Scheneider	Tata McGraw Hill
8	Society in India	Mandilbaum David	Popular Publications.
9	Sociology	Broom L., Selznick P. and Dorrock D.,	Harper International Publishing House.

Course Code	**HSS301 (d)**
Course Title	**German Basics for Engineering Students**
Type of Course	**Elective**
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic Electronics Engineering**
Course Objectives	1. To learn basic grammar of German language like articles of nouns, alphabet and numbers upto 1000, personal and possessive pronouns, verb conjugations, modal verbs. 2. To learn about German-speaking countries, capital cities, states and basic geography.
Course Outcome	1. Student will be able to understand and frame simple sentences in German language, in order to introduce oneself. 2. Student can enquire about others – e.g,. about their living place, their occupation and hobbies in German. 3. Student can seek some information at public places like the railway station, departmental stores, cafeteria etc. in German.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

Section-A

Lerneinheit (Chapter)	Themenkreis-1: Menschen und Reisen	11 hours
1	Fokus Strukturen	
2	Fokus Lesen	
3	Fokus Hören	
4	Fokus Sprechen	
5	Fokus Schreiben	

Lerneinheit (Chapter)	Themenkreis-2: Personen und Aktivitäten	12 hours
6	Fokus Strukturen	
7	Fokus Lesen	
8	Fokus Hören	
9	Fokus Sprechen	
10	Fokus Schreiben	

Section-B

Lerneinheit (Chapter)	Themenkreis-3: Wohnen und Leben	12hours
11	Fokus Strukturen	
12	Fokus Lesen	
13	Fokus Hören	
14	Fokus Sprechen	
15	Fokus Schreiben	
Lerneinheit (Chapter)	Themenkreis-4: Wollen und Sollen	10hours
16	Fokus Strukturen	
17	Fokus Lesen	
18	Fokus Hören	

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Lagune -1	Hartmut Aufderstraße a.o	Hueber Verlag.
2	Sociology: Themes and Perspective	Haralambos M	Collins Educational Publications.
RECOMMENDED BOOKS			
1	Lagune-1	Arbeitsbuch by Hartmut Aufderstraße a.o.,	Hueber Verlag.
2	Deutsche Sprachlehre für Ausländer	Schulz und Griesbach.	

Year: Second **Semester: Fourth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	AS401	Numerical Analysis	4-1-0	5	4	50	50	100	-
2	EE401	Electric Machinery-II	3-1-0	4	4	50	50	100	
3	EE451	Electric Machinery-II Lab	0-0-3	3	1	-	-	-	50
4	EE402	Control Engg.	3-1-0	4	4	50	50	100	
5	EE452	Control Engg. Lab	0-0-3	3	1	-	-	-	50
6	EE403	Power Systems-I	3-1-0	4	4	50	50	100	
7	EE453	Power Systems-I Lab	0-0-3	3	1	-	-	-	50
8	EE405	Microprocessor and Interfacing	3-1-0	4	4	50	50	100	-
9	EE455	Microprocessor and Interfacing Lab	0-0-3	3	1	-	-	-	50
Total			16-5-12	33	24	250	250	500	200

*Practical marks are for continuous and end semester evaluation

Course Code	**AS-401**
Course Title	**Numerical Analysis**
Type of Course	Core
L T P	4 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Calculus (MATHS-101)
Course Objectives (CO)	1. To understand the errors involved in computations and to estimate the errors 2. To learn method to solve system of equations 3. To learn the numerical methods to interpolate, extrapolate differentiate and integrate functions 4. To learn numerical methods to solve differential equation 5. To learn to optimize functions using various techniques including least square method and functional approximations.
Course Outcome	1. Ability to estimate errors in numerical result 2. Ability to solve system of equations 3. Ability to use numerical methods to interpolate, extrapolate differentiate and integrate functions 4. Ability to use numerical method to solve differential equations 5. Ability to learn to optimize various functions to minimize the errors in calculations
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

Section- A

1. Error Analysis

Relative error, Absolute error, Round-off error, Truncation error, significant digits and numerical instability. (Scope as in Section 1.3, Chapter 1 of Reference 1). (4 hours)

2. Transcendental and Polynomial Equations

Bisection method, Iteration Method based on first degree equation: Secant method, Regula-falsi method and Newton – Raphson methods, Rate of convergence of Secant method, Regula-Falsi method and Newton-Raphson Method. Bairestow's method to find quadratic factor of polynomial (Scope as in corresponding topics in Section 2.3, 2.5, 2.9 of Chapter 2 of Reference 1)

(8 hours)

3. Interpolation

Polynomial interpolation: Finite differences, Lagrange and Newton interpolation (Forward, Backward and Divided difference methods), inverse interpolation, Hermite interpolation (Scope as in corresponding topics in Section 4.1-4.3, 4.5 of Chapter 4 of Reference 1) (10 hours)

Section- B

4. Solution of Linear Systems

Gauss elimination method, Gauss-Seidel method, Cholesky's Decomposition. Matrix inversion: Gauss-Jordan method. Eigenvalue problem: Bounds on Eigenvalues (Gerschgorin and Brauer theorems), Householder's method for symmetric matrices, Power method (Scope as in corresponding topics in Section 3.2, 3.4, 3.6, 3.9, 3.11 of Chapter 3 of Reference 1).

(10 hours)

5. Numerical Integration

Trapezoidal Rule, Simpson's 1/3 and 1/8 rule, Romberg integration, Newton – Coates formulae (Scope as in corresponding topics in Section 5.7, 5.8 of Chapter 5 of Reference 1).

(5 hours)

6. Numerical solutions of ordinary differential equations

Taylor's series, Euler and Runge – Kutta methods. Finite difference methods for boundary value problems (Scope as in corresponding topics in Section 6.4 of Chapter 6 of Reference 1)

(5 hours)

7. Functional approximation: Chebyshev polynomials, Economization of power series, Least square approximation (Scope as in corresponding topics in Section 4.9 of Chapter 4 of Reference1).

(3 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	*Numerical Methods for Scientific and Engineering Computation*	M. K. Jain, S. R. K. Iyenger, R. K. Jain	Fourth edition New Age International Publishers, New Delhi 2004.
RECOMMENDED BOOKS			
1	S. S. Sastry. *Introduction Methods of Numerical Analysis*	R. V. Churchill, J. W. Brown	Fourth Edition, Prentice Hall of India, New Delhi, 2005.
2	*Computer Oriented Numerical Methods.*	V. Rajaraman	Third Edition, Prentice Hall of India, New Delhi, 1980
3	*.Applied Numerical Analysis,.*	C. F. Gerald, P. O. Wheatley	Sixth Edition, Pearson Education, Delhi, 2002

Course Code	**EE-401**
Course Title	**Electric Machinery-II**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic Electrical Engineering**
Course Objectives (CO)	1. To understand the working and constructional features of Electric Machines. 2. To understand the process to test, control and analyze the performances of Synchronous Machine. 3. To understand the applications of Electric Machines in the field. Introduction to special motors like Brushless DC motor, PM Brushless DC motor, universal motor, stepper motor, linear induction motor, Hysteresis motor and reluctance motor.
Course Outcome	1. To be able to explain the principle of operation of various Electric Machines 2. To be able to identify and select machines for specific applications. 3. To be able to apply control procedures for machines during operation. 4. To analyze the characteristics of Electrical Machinery.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Synchronous Machines

Introduction, basic synchronous Machine Model (Realistic Machine), Voltage regulation, Circuit model of synchronous machine, determination of synchronous reactance, Open circuit characteristic(OCC), short circuit characteristic (SCC), Short circuit ratio (SCR), short circuit loss, Determination of armature Reaction, ampere-turns and Leakage reactance of a synchronous machines-Potier method, Nature of armature reaction, salient pole synchronous machine-two reaction model, analysis of phasor diagram,

power angle characteristic, determination of X_d and X_q using slip test, V-curve, Inverted V-curve of synchronous machine, hunting in synchronous machines, damper winding, short circuit transients in synchronous machine, short circuit under loading conditions, single phase synchronous generators, synchronous condenser. **(22 hours)**

SECTION-B

Parallel operation of alternators

Synchronizing to infinite Bus-Bars, synchronoscope, parallel operation of alternators, Operating characteristics, generating Machine, motoring machine, power angle characteristic, operation at constant load with variable excitation, generating Machine, motoring machines, minimum excitation, observation, compounding curve, synchronous condenser, consideration of armature resistance, power flow (transfer) equations.

(14 hours)

Special motors:

Brushless dc motors, schematic and operation, circuit model characteristics of brushless dc motor, PM Brushless dc machine, universal motor and stepper motor, linear induction motor, Hysteresis motor, reluctance motors.

(9hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Electrical Machines	I.J Nagrath, D.P. Kothari	TMH Publishing Company, 2002.
2	Electrical Machinery	P.S. Bhimbhra	Khanna Publishers, 2003.
RECOMMENDED BOOKS			
1	Electrical Machinery and Transformers	Bhag S. Guru and Huseyin R. Hiziroglu	New York Oxford University Press 2004
2	Electrical Machines	Smarjit Ghosh,	Pearson Education Singapore PTE. Ltd. 2005
3	Electric Machinery	A.E. Fitzgerald, Kingsley, Umans	TMH Publishing Company, 2002

Course Title	Electric Machinery-II Lab		Credits	01
Course Code	EE-451	Max Marks-50	P	03

List of Experiments

1. To determine phase sequence of three phase supply system.
2. To perform no load test on a 3-phase alternator (cylindrical rotor).
3. To perform short circuit test on a 3-phase alternator (cylindrical rotor). Measure the resistance of stator winding of alternator. Find out regulation of alternator at full load at (i) unity power factor (ii) 0.85 Power factor lagging (iii) 0.85 Power factor leading using synchronous impedance method.
4. To perform the slip test to determine the X_d and X_q.
5. To determine the V and inverted V curves of the synchronous machine working under different loaded conditions.
6. To synchronize an alternator with the 3 phase bus bar.
7. To perform the parallel operation of two alternators.
8. To obtain positive, negative and zero sequence impedances of a 3-phase synchronous generator.
9. Study of speed control of brushless DC motor.
10. Study of speed –torque characteristics of universal motor on DC operation/ AC operation.

Course Code	**EE-402**
Course Title	**Control Engineering**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic Electrical Engineering**
Course Objectives (CO)	1. To understand the introductory concepts of control systems. 2. To study the time domain analysis and frequency domain analysis of control systems.
Course Outcome	1. Students will be able to understand the introductory concepts of control systems with their illustrative examples. 2. Students will be able to outline the basic concept of modelling of control systems. 3. Students will be able to do the time domain analysis of control systems. 4. Students will be able to do the frequency domain analysis of control systems.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Introductory Concepts

Open loop and closed loop control systems, Servomechanisms, feedback and effects of feedback, linear and non- linear systems, time variant & invariant, continuous and sampled data control systems, illustrative examples.\

(5 hours)

Modelling

Mathematical models of linear electrical, mechanical, translational, rotational, gear, thermal, pneumatic and hydraulic systems, electrical and mechanical analogies. Laplace transforms Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

(6 hours)

Time Domain Analysis
Typical test-input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and error co-efficient.

(6 hours)

Stability
Concepts of absolute and relative stability, pole –zero location, Routh-Hurwitz stability criterion.

(5 hours)

SECTION-B

Root Locus Technique
Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain & sketch of the root locus plot, Rules for construction of root locus, root contours, root sensitivity, generalized root locus.

(6 hours)

Frequency Domain Analysis
Closed loop frequency response, Relation between time and frequency response for second order systems. Frequency response specification, Bode plots, stability and loop transfer function. Polar Plot, Nyquist criterion, Gain Margin and Phase Margin. Nichol's chart, M and N circles.

(11 hours)

Control Components
Error detectors- potentiometers and synchros, a.c. and d.c. servo motors, brushless d.c. motors, A.C. and D.C. techogenerators, stepper motors.

(6 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
RECOMMENDED BOOKS			
1	Control System Engineering	I.J. Nagrath & Gopal,	New Age International (P) Limited , New Delhi, 3rd edition ,2004
2	Modern Control Engineering	K. Ogata	Pearson Education, New Delhi, 3rd Indian Reprint Edition, 2004.
3	Automatic Control System	B. C. Kuo	Prentice Hall of India, Seventh Edition.

Course Title	Control Engineering Lab		Credits	01
Course Code	EE-452	Max Marks-50	P	03

Note: At least eight experiments are to be performed out of the following ten experiments.

1. To measure open loop response of AC servomotor and determination of transfer function using computer interfacing.
2. To measure closed loop response of AC servomotor and determination of transfer function using computer interfacing.
3. To study the input-output characteristics of a potentiometer and to use a potentiometer as an error detector.
4. To study transmitter – receiver characteristics of a synchronous set and to use the set as control component.
5. To study the operation of dc position control system.
6. To study the operation of dc speed control system.
7. Introduction to MATLAB.
8. Basic programs in MATLAB.
9. Introduction to control system toolbox and SIMULINK.
10. Programs in control system toolbox like bode plot, nyquist plot, root locus, time responses.

Recommended Experiments:

11. To study Missile System using SIMULINK in MATLAB.
12. To study Sun-seeker System using SIMULINK in MATLAB.

Course Code	**EE-403**
Course Title	**Power System-I**
Type of Course	**Core**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 **50** **50**
Course Prerequisites	**Basic Electrical Engineering**
Course Objectives (CO)	1. To understand the basic structure of power system. 2. To understand the role of insulators and towers. 3. To understand the various parameters of transmission lines. 4. To understand the importance of transmission lines and their operation.
Course Outcome	1. Students will be able to understand the basics of power system. 2. Students can understand the various types of conductors and supporting structures for overhead power transfer. 3. Students can determine the parameters transmission lines under different types of configuration. 4. Students can identify the performance of transmission lines.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Supply Systems

Introduction to Power System, Per unit system, Layout of power supply network, System interconnection, AC and DC supply system-comparison of conductors costs.

(4 hours)

Conductors and Underground Cables

Types of conductors: Hard drawn copper conductors, AAC, AAAC, ACSR and bundled conductors, Resistance, Skin effect, Proximity Effect

Types of Underground cables, capacitance of single core cables, grading of cables, capacitance of three core belted cables, power factor and heating of cables (6 hours)

Insulators and Supporting Structures

Types of insulators, voltage distribution across suspension insulators, string efficiency, methods of improving string efficiency.

Line supports- Towers and Poles, Vibration of conductors, Effect of vibration on transmission lines, Prevention of vibration, Sag and tension–Various methods of sag and tension calculations, Loading on conductors and it affects, Span of equal and unequal lengths.

(7 hours)

Transients of Transmission lines

Transmission-line transients, Transient Analysis: Travelling Waves, reflections and refraction of waves.

(6 hours)

SECTION-B

Transmission-Line Parameters

Conductance and Inductance: Solid Cylindrical Conductor, Inductance: Single-Phase Two-Wire Line and Three-Phase Three-Wire Line with Equal Phase Spacing, Composite Conductors, Unequal Phase Spacing, Bundled Conductors, Series Impedances: Three-Phase Line with Neutral Conductors and Earth Return, Electric Field and Voltage: Solid Cylindrical Conductor

Capacitance: Single-Phase Two-Wire Line and Three-Phase Three-Wire Line with Equal Phase Spacing, Stranded Conductors, Unequal Phase Spacing, Bundled Conductors

(13 hours)

Transmission Lines: Steady-State Operation

Medium and Short Line Approximations, Transmission-Line Differential Equations, Equivalent [pi] Circuit, Lossless Lines, Maximum Power Flow, Line Loadability, Reactive Compensation Techniques.

(9 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
	Power System Analysis	Grainger & Stevenson	Tata McMcGraw-Hill 2000.
	Modern Power System Analysis	D.P. Kothari and I.J. Nagrath	3rd Edition,TMH,2003.
	Electrical Power Systems	Ashfaq Husain	CBS Publishers and Distributors Pvt Limited, 5th Edition
RECOMMENDED BOOKS			
1	Electric Power Systems	D. Das	1st edition.New Age International, 2006.
2	Power System Analysis	A.R. Bergen and V.Vittal	Second Edition, Pearson, 2000.
3	Power System Analysis and Design	J. D. Glover, M. S. Sarma,	4th edition 2007 Thomson-Brooks/Cole 2002.

Course Title	Power System-I (Lab)		Credits	01
Course Code	EE-453	Max Marks-50	P	03

Design/analysis/ simulate/projects relating to the following.

1. Determination of ABCD parameters by experimental measurement using teo-port method and by knowing components values and its verification.
2. Line loadability.
3. Steady state operation of transmission lines.
4. To study different types of underground cables.
5. To study different types of insulators.
6. To study various supporting structures.
7. Ferranti effect
8. Power factor improvement

Add –On Experiments

1. Load test and calculations of regulation, efficiency of transmission lines
2. Working of bi-directional three phase AC measurement panel, observing flow of real and reactive power.
3. Static Var compensation

Course Code	**EE-405**
Course Title	**Microprocessor and Interfacing**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic Electrical Engineering**
Course Objectives (CO)	1. To understand the basic concepts of a Microprocessor. 2. To understand the Architecture of microprocessor 8085. 3. To know Assembly language programming of 8085. 4. To understand the key concepts of Interfacing. 5. To understand the Architecture of 8086
Course Outcome	1. Students will understand fundamental concepts of Microprocessors 8085 and of 8086 2. Students will analyse Architecture of 8085 and 8086 3. Students will learn the 8085 Assembly language Programing . 4. Students will be able to learn real world Interfacing of Microprocessor which includes both hardware and software concepts.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Microprocessor Architecture and Microcomputer Systems

Microprocessor Architecture & Operations , Memory, Input and Output Devices, The 8085 MPU, Example of an 8085-Based Microcomputer, Memory Interfacing**.** (4 hours)

Programming the 8085

Introduction to 8085 Assembly Language Programming, The 8085 Programming Model, Instruction Classification, Instruction Format. Data Transfer (Copy) Operations, Arithmetic Operations, Logic Operations, Branch Operations, Writing Assembly Language Programs (6 hours)

Programming Techniques
Looping, Counting and Indexing, Additional Data Transfer and 16-Bit Arithmetic Instructions, Arithmetic Operations Related to Memory, Logic Operations. (06 hours)

Counters and Time Delays
Counters and Time Delays, Hexadecimal Counter, Modulo Ten Counter, Generating Pulse waveforms (04 hours**)**

Stack and Subroutines
Stack, Subroutine, Restart , Conditional Call and Return Instructions**.** (03 hours**)**

SECTION-B

Interrupts
The 8085 Interrupt, 8085 Vectored interrupts , Interfacing I/O Devices (04 hours)

Basic Interfacing Concepts
Interfacing Output Displays, Interfacing Input Devices, Memory- Mapped I/O, Interfacing Data Converters, Digital- to- Analog (D/A) Converters, Analog- to- Digital (A/D) Converters (06 hours)

General –Purpose Programmable Peripheral Devices
The 8255A Programmable Peripheral Interface- I/O Mode and BSR Mode (04 hours)

Serial communication
Basic communication concepts in serial I/O , RS232C (04 hours)

8086 Microprocessor
8086 CPU Architecture , Segmented memory, Addressing modes (04 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh S.Gaonkar,	
2.	The 8086/8088 family Design Programming & Applications	John Uffenbeck	
RECOMMENDED BOOKS			
1	Electric Power Systems	D. Das	1st edition.New Age International, 2006.
2	Microprocessors and Interfacing programming and Hardwar	Douglas V. Hall	TMH.

Course Title	Microprocessor and Interfacing Lab		Credits	01
Course Code	EE- 455	Max Marks-50	P	03

Note: Practical should be covered based on the following directions:

List of Experiments:
1. Familiarization of 8085 kits.
2. Verification of arithmetic and logic operations using above kits. (At least 5 programs)
3. Application of assembly language using 8085 instructions set for programing.
4. Applications of data movement instructions to develop relevant programs.
5. Development of interfacing circuits of various control applications based on 8085.

Year: Third **Semester: Fifth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE-501	Power Systems-II	3-1-0	4	4	50	50	100	-
2	EE-551	Power Systems-II Lab	0-0-3	3	1	-	-	-	50
3	EE-510	MicroControllers	3-1-0	4	4	50	50	100	-
4	EE-560	MicroControllers Lab	0-0-3	3	1	-	-	-	50
5	EE-507	Communication Engg.	3-1-0	4	4	50	50	100	-
6	EE-557	Communication Engg. Lab	0-0-3	3	1	-	-	-	50
7	EE-508	Electromagnetic Filed Theory	3-1-0	4	4	50	50	100	-
8	EE-509	Control Engineering-II	3-1-0	4	4	50	50	100	-
9	EE-559	Control Engineering-II Lab	0-0-3	3	1	-	-	-	50
10	EE-556	Vocational Training after Fourth Semester	0-0-0	-	1	-	-	-	50
Total			15-5-12	32	25	250	250	500	250
Subjects offered by DIC (OPTIONAL)									
11	DIC-01	Principles of Design Engineering and Product Development	0-0-3	3	2	-	-	-	100

*Practical marks are for continuous and end semester evaluation

Course Code	**EE-501**
Course Title	**Power Systems-II**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic Electrical Engineering**
Course Objectives (CO)	1. To understand the need of protection of power system. 2. To understand the protection of transformer, generator, bus zone and transmission lines. 3. To understand the construction, working and application of various types of circuit breakers. 4. To understand the causes and protection of overvoltages. 5. To understand the concept of grounding and various types of neutral grounding.
Course Outcome	1. Students can outline the components of a power system protection. 2. Students will be competent to design protection system for transformer, generator, bus zone and transmission lines. 3. Students will be able to extend the construction and working of various circuit breakers for protection system. 4. Students will be able to illustrate the concept of over-voltages of power system. 5. Students will be able to demonstrate the importance of different types of neutral grounding.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Introduction

Three phase short circuits, Sudden short circuit at the armature terminals of a three phase generator, Transients in R-L series circuits, Introduction to symmetrical components, sequence networks of synchronous machines and transformers. (8 hours)

Power System Protection

Power System Protection Components, Instrument Transformers, Overcurrent Relays, Radial System Protection, Reclosers and Fuses, Directional Relays, Protection of Two-Source System with Directional Relays, Zones of Protection, Line Protection with Impedance (Distance) Relays, Differential Relays, Bus-bar arrangements, Bus Bar Protection using Differential Relays, Transformer Protection with Differential Relays, Generator protection with differential relays, Introduction to static relays and Digital Relaying. (14 hours)

SECTION- B

Circuit Breakers

Transient recovery voltage, resistance switching, first pole to clear factor, Transient recovery voltage, arc and arc extinction, volt ampere characteristics of arc, methods of arc extinction, construction, working and applications of air-break circuit breakers, oil circuit breakers, vacuum circuit breakers, air blast circuit breakers, SF6 circuit breakers, circuit breaker ratings. (9 hours)

Power System Overvoltages

Causes of Overvoltages: Internal and external, Protection against over voltages by shielding or ground wires and lightning arrestors, Location of lightning arrestor, Selection of lightning arrestor, Basic insulation level, insulation coordination. (6 hours)

Grounding

Grounding fundamentals, Ground resistance, step voltage, touch voltage and transferred voltage, tolerable step and touch voltages, ground resistance of a hemisphere and driven rod, Ground resistance, Step and Mesh voltages of a grounding grids

Neutral grounding: ungrounded systems, resonant grounding, solid or effective grounding, reactance grounding, earthing transformer, neutral grounding practice. (8 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Power System Analysis and Design	J. D. Glover, M. S. Sarma	Thomson-Brooks/Cole, 2002
2.	Power System Engineering	I. J. Nagrath, D. P. Kothari,	TMH, 1994
3.	Guide for Safety in AC Substation Grounding,	IEEE	ANSI/IEEE Std. 80-2000, 2000
RECOMMENDED BOOKS			
1	Electric Power Generation, Transmission and Distribution	S.N. Singh	PHI, 2003.
2	Electric Power System	Weedy & Cory	John Wiley & Sons, 1999
3	IS:3043 -1987, Indian Standard Code of Practice for Earthing,		BIS, New Delhi, 1987
4	Fundamentals of Power System Protection	Y. G. Paithankar and S. R. Bhide	PHI, 2003

Course Title	Power Systems - II Lab		Credits	01
Course Code	EE- 551	Max Marks-50	P	03

Note: At least eight experiments / projects / technical reports relating to the following:

1. Measurement of soil resistivity and soil model evaluation
2. Measurement of ground resistance.
3. To study the characteristics of over current relay.
4. To study the characteristics of percentage differential relay.
5. To study the characteristics of distance relay.
6. To study current time characteristics of fuses.
7. To study current time characteristics of circuit breaker.
8. Technical visit to a substation/generating station, Load Dispatch Centre and preparation of a technical report for the same
9. Conventional and renewable energy sources
10. Distribution system design
11. Digital relaying
12. Reactive compensation of lines

Add-on Experiments

1. To study distribution board.
2. To study protection system of a distribution transformer.

Course Code	**EE510**
Course Title	**Microcontrollers**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic knowledge of Microprocessors**
Course Objectives (CO)	1. To understand the architecture of 8051 2. To study the instruction set and programming of 8051 microcontroller 3. To know the techniques of interfacing 8051 to peripheral devices. 4. To impart knowledge on architecture and key concepts of PIC microcontoller
Course Outcome	1. Acquired knowledge about the architecture of 8051 2. Acquired knowledge of assembly language programming concepts of 8051 3. To understand peripheral interfacing with microcontrollers 8051 4. To understand architecture and programing concepts of PIC microcontroller
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

8051 Micro Controller

Architecture, Pin configuration, SFR's, Memory, Registers ,Banks , Program Counter , 8051 Addressing modes (5 Hours)

8051 Instructions:

Introduction to 8051 assembly language programming: JUMP, LOOP and CALL instructions

arithmetic instructions: unsigned addition and subtraction, unsigned multiplications and division, signed number concepts and arithmetic operations, logic , compare and rotate instructions.single bit instruction programming, single bit operations with CY.Time delay calculations and programming (6 Hours)

Input Output Programming:
I/O bit manipulation programming, single bit operations with CY, reading input pins vs port latch, 8051 timer and counter programming (4 Hours)

8051 Serial Communication:
Basics of serial communication ,8051 connection to RS 232, 8051 serial communications programming (4 Hours)

8051 Interrupts and Interfacing:
8051Interrupts, Interrupt Priority in the 8051, LCD and keyboard interfacing (5 Hours)

PART-B

PIC18F Family:
The Architecture of PIC family of devices, PIC18F Memory,Registers,Program Counter Bank switching addressing modes . (6 Hours)

Programming model
PIC18F programming model, instruction set, instruction format. data copy, arithmetic, branch, logical, bit manipulation and multiply-divide operations, stacks, subroutines, time delay,instruction pipeline (9 Hours)

I/O Ports ,Interrupts and Timers of PIC:
Brief concepts of I/O Ports Timers and Interrupts of PIC microcontroller

(6 Hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
RECOMMENDED BOOKS			
1.	The 8051 Microcontroller and Embedded System	Muhammad Ali Mazidi, Janice Gillespie Mazidi	Pearson Education
2.	The 8051 Microcontrollers	Ayala	Penram Publications
3.	PIC Microcontroller and Embedded Systems	Muhammad Ali Mazidi, Rolin D.McKinlay, Danny Causey	Penram Publications

4.	Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family)	Ramesh Gaonkar	Penram Publications
5.	The 8051 Microcontroller	Mackenzie	Pearson education
6.	Designing with PIC Microcontrollers	John B Peatman	Pearson education
7.	Embedded C Programming and the Microchip PIC	Barnett Cox & O'Cull	Thomson, 2006.

Course Title	Microcontrollers Lab		Credits	01
Course Code	EE-560	Max Marks-50	P	03

List of Experiments:

Note: *At least* ***eight*** *experiments to be done*

1. To study development tools/environment for 8051 microcontroller programming.
2. Write an assembly language program to add, subtract, multiply, divide .
3. Write an assembly language program to pack/unpack BCD numbers.
4. Write an assembly language program to treat a series of numbers.
5. Study and analyze the interfacing of LCD using 8051 microcontroller
6. Study and analyze the interfacing of seven segment display using 8051 microcontroller
7. Study of implementation of Stepper Motor interfacing with 8051microcontroller .
8. To study implementation and programming of Temperature measurement using 8051.
9. Study and analyze the interfacing of a Relay using 8051 microcontroller
10. Study and analyze the interfacing of buzzer using 8051microcontroller.
11. Study and analyze the interfacing of ADC using 8051 microcontroller.

Course Code	**EE-507**
Course Title	**Communication Engineering**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Knowledge of Analog Electronics and digital electronics**
Course Objectives (CO)	1. To develop students with solid foundation in mathematical, engineering fundamentals to solve communication engineering problems. 2. To provide students rigorous training to design and develop electronics systems, such as AM, FM transmitter used in real life. 3. To provide a platform to the students to get them acquainted with issues related to engineering technologies in communication engineering and their impact on global economy.
Course Outcome	1. Students will understand various modulation techniques and would be able to generate IC based AM, FM signal. 2. Students will understand various demodulation techniques and will recover original information signal. 3. Students would also be capable to identify various modulation and demodulation techniques and able to solve communication engineering problems theoretically and practically. 4. Students will understand impact of various modulation techniques on resources such as bandwidth utilization and its effect on global economy. 5. Students will be capable to calculate bandwidth for AM, FM transmitter using modern instruments like digital storage oscilloscope.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Amplitude Modulation and Demodulation

Concept of modulation its merits & demerits, Principle and generation of AM, DSB-SC, SSB signals, Detection of AM, DSB-SC, and SSB signals, Noise in AM systems, Super heterodyne Receivers, Diversity reception. (12 hours)

Frequency Modulation and Demodulation

Principle and generation of FM signals, Detection of FM signals, Foster Discriminator, Ratio and PLL detectors, Noise consideration in FM, Pre-emphasis and de-emphasis circuit.

(11 hours)

SECTION-B

Pulse Modulation & Demodulation

Principle, generation and detection of PAM, PWM, PPM & PCM signals, Bandwidth consideration, Companding, Delta modulation, Adaptive delta modulation systems.

(12 hours)

Digital Modulation Techniques

Coherent binary: Amplitude shift keying, Phase shift keying, Frequency shift keying, Quadrature phase shift keying. (10 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
4.	Electronic Communication Systems	G. Kennedy ,	Pub: Mc Graw Hill, Edition 4th
5.	Principles of Communication Systems	Taub and Schilling	Edition 2nd
6.	Communication Systems (Analog and Digital)	Sanjay Sharma	Edition 4th
7.	Analog and Digital Communication,	Lathi B. P., Modern	Oxford University Press, Edition 3rd
RECOMMENDED BOOKS			
1	Communication Systems	Simon Haykin	John Wiley Publication, Edition 3rd
2	Digital Communication System	Proakis John G.,	McGraw, Edition 4th

Course Title	Communication Engineering Lab		Credits	01
Course Code	EE- 557	Max Marks-50	P	03

List of Experiments:

1. Study of amplitude modulation (AM).
2. Determine the modulation index of amplitude modulated (AM) wave.
3. Study of Double Sideband AM Reception.
4. Study of frequency modulated (FM) wave.
5. Study the demodulation of frequency modulated (FM) wave.
6. Study of pulse amplitude modulation (PAM) using natural and flat top sampling.
7. Study of pulse width modulation (PWM) and pulse position modulation (PPM).
8. Study of pulse code modulation (PCM) transmitter and receiver.
9. Study of delta modulation (DM) and adaptive delta modulation (ADM).
10. Study of ASK, FSK and PSK techniques.

Experiments beyond curriculum

i. To measure sensitivity, selectivity, fidelity and alignment arrangement for a communication receiver.

ii. Study of time division multiplexed and frequency division multiplexed signals.

Project work related to designing of communication transmitters and receivers.

Course Code	**EE-508**
Course Title	**Electromagnetic Fields Theory**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic knowledge of Coordinate systems, Electric and Magnetic fields**
Course Objectives (CO)	1. To learn basic coordinate system, significance of divergence, gradient, curl and its applications to EM fields. 2. To understand the boundary conditions for different materials/surfaces. 3.To get the basics of microwave, transmission lines and antenna parameters.
Course Outcome	1. Students will apply knowledge of mathematics to solve numerical based on Coulombs law, Gauss law, Biot Savarts law, Amperes Circuital law etc. 2. Students will understand impact of the EM course in many engineering core subjects like optical fiber communication, microwave engineering, antenna engineering etc and its impact on the technology used by the society.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Static Electric Fields

Introduction to Coordinate System, Rectangular, Cylindrical and Spherical Coordinate System. Introduction to line, Surface and Volume Integrals ,Definition of Curl, Divergence and Gradient, Stokes theorem and Divergence theorem, the Laplacian operater,Coulomb's Law, Electric Field Intensity, Electric Field due to several point charges ,Electric field due to volume charge, Electric Field due to line charge , Electric Field due to a sheet of charge. Electric Flux Density, Gauss's Law and its applications. (12 hours)

2.Poisson's Equation and Laplace's Equation

Laplace's equation, solution of Laplace's equation in rectangular coordinates, Cartesian solution in one dimension, laplace's equation in cylindrical coordinates,Laplace's equation in spherical coordinates, Poisson's equation, capacitor, capacitance of parallel plate capacitor,capacitance of conducting spheres, capacitance of coaxial cable. current density, Ohm's law,Continuity equation. (11hours)

SECTION -B

Static Magnetic Fields

Magnetic Flux and magnetic Flux density, Biot-Savart's Law , Magnetic field of a circular current carrying loop,Magnetic field of a solenoid,Magnetic Field intensity, Ampere's circuital law and simple applications, Self inductances of various geometries,Magnetic boundary conditions. (12 hours)

Time Varying Fields and Maxwell's Equation

Displacement current, Modified form of Ampere's circuital law, Maxwell's Equation in differential form, Maxwell's equation in integral form,Maxwells equation in free space and harmonically varying fields,Wave equation in conducting and non conducting medium Poynting Theorem. (10 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Engineering Electromagnetics	W H.Hayt& J A Buck	TATA McGraw-Hill, 7thEdition 2007
2.	Electromagnetic Waves and Radiating Systems.	E.C. Jordan & K.G. Balmain	Pearson Education/PHI 4nd edition 2006
3.	Electromagnetics with Applications	John Krauss and Daniel A Fleisch,	McGraw-Hill, 5th edition, 1999.
RECOMMENDED BOOKS			
1	Elements of Engineering Electromagnetics	Matthew N.O.Sadiku	Oxford University Press, 4th edition, 2007
2	Elements of Engineering Electromagnetic	NarayanaRao, N	6^{th} edition, Pearson Education, New Delhi, 2006
3	Fields and Waves in Communications Electronics	Ramo, Whinnery and Van Duzer	John Wiley & Sons ,3rd edition 2003
4	Field and Wave Electromagnetics	David K.Cheng	Second Edition- Pearson Edition, 2004.

Course Code	**EE-509**
Course Title	**Control Engineering-II**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Knowledge of basic control engineering.**
Course Objectives (CO)	1. To understand the basic concept of state space analysis of control systems. 2. To understand the need of design of control systems. 3. To understand the concept of digital control systems and non-linear control systems.
Course Outcome	1. Students will be able to explain state space analysis of control systems. Students will understand the need of design of control systems. 2. Students will be able to demonstrate various controllers as used in control systems. 3. Students will be able to analyze the basic concept, need and application of digital control systems.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

State Space Analysis: Introduction, Features of state space models, State variables, State space representation, Transfer function, Solution of state equations, Concept of controllability and observability.

(9 hours)

Controllers: Introduction, Time proportional ON/OFF controllers, Proportional controllers, Integral controllers, Derivative controllers, Proportional-integral controllers, Proportional-derivative controllers, PID controllers, Tuning of PID controllers-various methods: Ziegler Nichols method, Kuhn-Kohn method.

(6 hours)

Design of Control Systems: Introduction, approaches to design, Cascade compensation network, Phase-lead design using bode diagram, Phase-lead design using root locus, Phase-lag design using bode diagram, Phase-lag design using root locus.

(8 hours)

SECTION-B

Digital Control Systems: Introduction, Sampling process, Signal reconstruction, z-transform, z-transfer function, Inverse z-transform, Pulse transfer function of sampled data control system, z and s-domain relationship, Stability analysis of sampled data control system in z-plane.

(12 hours)

Applications of Digital Control Systems: Digital temperature control system, Digital position control system, Stepper motor and its control, Programmable logic controllers.

(10 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
RECOMMENDED BOOKS			
1	Digital Control and State Variable Methods	M Gopal	McGraw Hill Education Private Limited , New Delhi, 4th Edition
2	Modern Control Engineering	K. Ogata	Pearson Education, New Delhi, 3rd Indian Reprint Edition, 2004.
3	Automatic Control System	B. C. Kuo	Prentice Hall of India, 7th Edition.

Course Title	Control Engineering-II		Credits	01
Course Code	EE-559	Max Marks-50	P	03

Note: At least eight experiments are to be performed out of the following nine experiments.

1. To study proportional controller characteristics for different parameters/constants using computer interfacing.
2. To study integral controller characteristics for different parameters/constants using computer interfacing.
3. To study derivative controller characteristics for different parameters/constants using computer interfacing.
4. To study proportional-integral-derivative controller characteristics for different parameters/constants using computer interfacing.
5. To study temperature measurement process using PID controller with computer interfacing.
6. To design different compensating networks for the given cut off frequency response.
7. To measure open loop response of lead-lag compensator with sine wave input and drawing bode plot.
8. To study PID tuning using Zeigler-Nichols first method.
9. To study PID tuning using Zeigler-Nichols second method.

Recommended Experiments:

10. Modelling and simulation of process control system using SIMULINK and observe different parameters/responses.
11. To study flow control loop using Process Control Trainer kit.

Course Code	**DIC-01**
Course Title	**Principles of Design Engineering and Product Development**
Type of Course	**Elective**
L T P	0 0 3
Credits	2
Course Assessment Methods	100
Course Prerequisites	**Knowledge of basic control engineering.**
Course Objectives (CO)	1. Conceptualisation and development of innovative, commercially important and socially sound decisions related to engineering products, processes and systems. 2. To train students to translate academic developments in electronics, computational, materials and energy engineering to real life applications of interest to industry for accelerated start of career.
Course Outcome	
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Introduction to designing

Fundamentals of engineering designs and applications; social, economic, sustainability, environmental and aesthetic rationales in design engineering, design decisions related to customer focus, competitiveness of products, processes, services and systems. Impact of product design on business and market, product portfolio development through continuity in designing. (11 hours)

Managing technologies and innovations

Technology road mapping, market and trend analyses for design decisions, managing technology and innovations, protecting designs by intellectual property rights, IPR gap analysis, creative thinking, technology sharing and transfer, founding start up companies, raising seed funding, challenges of conceiving, creating and growing a new venture. (12 hours)

SECTION- B

Design process

Principles, tools and strategies for conceptualising the need and presenting designs - product specifications, digital tools, analog drawings, design modeling: mathematical modeling, simulation using computers, and creation of 2D and 3D scale models. Engineering fundamentals related to mechanical, electrical, electronic and computational concepts in designing; environmental, sustainability, life cycle analysis; upstream manufacturing economics and downstream assembly, distribution, recyclability, robustness, maintenance and safety aspects in design development; functional prototypes, iterations, validation of product concept, product development. (10 hours)

Challenges of Energy in Engineering Designs

Energy source, quality, costing, storage, utilisation, conservation and sustainability in engineering designs. Examples by case studies and minor projects on small energy capure, storage and management technologies. (12 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
RECOMMENDED BOOKS			
1	Design Thinking	Michael Luchs, Scott Swan, Abbie Griffin	John Wiley & Sons, Inc(ISBN 978-1-118-97180-2)
2	Journal of Product Innovation Management,		Wiley Online Library .
3	Product Design for Manufacture and Assembly.	Geoffrey Boothroyd, Peter Dewhurst and Winston A Knight	2011. CRC Press.
4	Engineering Design Methods: Strategies for Product Design.	Nigel Cross,	Wiley & Sons (ISBN 978-0-470-51926-4)
5	Mechanical Engineering Design.	Richard G Budynas and J Keith Nisbett	Mc Graw Hill (ISBN 978-0-07-352928-8).

Year: Third **Semester: Sixth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE-601	Computer Aided Power Systems Analysis	3-1-0	4	4	50	50	100	-
2	EE-651	Computer Aided Power Systems Analysis Lab	0-0-3	3	1	-	-	-	50
3	EE-611	Programmable Logic Controller and Distributed Control System	3-1-0	4	4	50	50	100	-
4	EE-661	Programmable Logic Controller and Distributed Control System Lab.	0-0-3	3	1	-	-	-	50
5	EE-612	Signals and Systems	3-1-0	4	4	50	50	100	-
6	EE-613	Energy Management & auditing	3-1-0	3	4	50	50	100	-
7	EE-663	Energy Management & auditing Lab	0-0-3	3	1	-	-	-	50
8	EE-606	Power Electronics	3-1-0	4	4	50	50	100	-
9	EE-656	Power Electronics Lab	0-0-3	3	1	-	-	-	50
Total			15-5-12	32	24	250	250	500	200
Subjects offered by DIC (OPTIONAL)									
	DIC-02	Sensors based Application Systems	3-1-0	4	4	50	50	100	-

Course Code	**EE-601**
Course Title	**Computer Aided Power Systems Analysis**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Knowledge of Power System-I and Synchronous Machines**
Course Objectives	1. To learn about the power system analysis using power flow. 2. To understand the importance of per unit system in power system. 3. To be competent in understanding power system stability. 4. To learn about various types of faults and their analysis.
Course Outcome (s)	1. Students will be confident in solving power system load flow problems in real life. 2. Students will be able to analyze and design a power system. 3. Students will be competent to study power system response under sudden load change conditions. 4. Students will be competent to analyze power system under various fault conditions may be symmetrical or unsymmetrical.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 5 conceptual questions of 2 marks each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION A

Power Flow Studies

Introduction to per unit system, advantages of per unit system, Power-Flow Problem, Power-Flow Solution by Newton-Raphson method, Power-Flow Solution by Gauss-Seidel Method, Control of Power Flow. (7 hours)

Power System Controls

Generator-Voltage Control, Turbine-Governor Control, Load-Frequency Control (single area and two area case), Economic load Dispatch. (6 hours)

Transient Stability Studies

Introduction of power system stability, The Swing Equation, Simplified Synchronous Machine Model and System Equivalents, Stead state stability, Transient stability, The Equal-Area Criterion for sudden change in mechanical input, sudden loss of one parallel lines, sudden short circuit on one parallel lines and effect

of clearing time on stability, Numerical solution of Swing Equation, Design Methods for Improving Transient Stability. (10 hours)

SECTION B

Symmetrical Faults

Power System Three-Phase Short Circuit fault and its analysis, Bus Impedance Matrix formation using step-by-step algorithm.

(10 hours)

Unsymmetrical Faults Analysis

Introduction to Symmetrical Components, Power in Sequence Networks, Sequence Networks of power system components. Single Line-to-Ground Fault, Line-to-Line Fault, Double Line-to-Ground Fault, Computer method of fault calculations. (12 hours)

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Power System Analysis	Grainger & Stevenson	Tata Mc-McGraw-Hill 2000.
TEXT BOOKS			
2	Power System Analysis and Design	J. D. Glover, M. S. Sarma	Thomson-Brooks/Cole
3	Modern Power System Analysis	D.P. Kothari and I.J. Nagrath	Third Edition, TMH,2003
4	Power System Analysis	Hadi Sadat	Tata McGraw Hill 2002
RECOMMENDED BOOKS			
1	Power System Analysis	A.R. Bergen and V.Vittal	Second Edition, Pearson, 2000.

Course Title	Computer Aided Power Systems Analysis Lab		Credits	01
Course Code	EE- 651	Max Marks-50	P	03

Note: At least five design / analysis projects relating to Sr. No 4-10 can be Performed while Sr. No. 1-3 are compulsory.

1. Introduction to MATLAB Software
2. Formulation of Y_{bus}using MATLAB Software
3. Formulation of $Z_{bus}$for a system using step-step algorithm using MATLAB Software
4. Symmetrical Fault analysis
5. Unsymmetrical Fault analysis
6. Power flow analysis.
7. Power flow control
8. Economic dispatch
9. Transient stability studies.
10. Load frequency control
11. Fault analysis using power world simulator

Course Code	**EE-611**
Course Title	**Programmable Logic Controller and Distributed Control System**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Knowledge of basic electrical engineering and digital electronics.**
Course Outcome (s)	1. Student will be able to identify logical process control in automation (PLC and DCS based automation). 2. Student will be able to connect the peripherals devices with the PLC for logical functioning. 3. Student will be able to develop PLC programmes and connect hardware for practical applications.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Logical Process Control in Automation

Introduction to process control , Continuous Process Control , Discrete-state Process Control , Composite Process Control , Data logger, DDC, SCADA , Scope of automation in industry. (7 hours)

PLC Architecture

Introduction to PLC, Configuration of PLC(components for modularized PLC) , Architecture of PLC , Working of PLC ,PLC peripherals , PLC symbols , Selection criteria of PLC , Advantages and disadvantages of PLC, PLCapplications. (7 hours)

PLC Peripherals and Wiring

Analog input/ output module , Digital input/ output module , Switching devices (level, pressure, flow, temperature, timer, proximity switch), PLC input/output connection, PLC power connection (wiring), Isolated and non-isolated input/output wiring to PLC **(8** hours)

SECTION-B

Basic PLC Programming

Introduction to General PLC Programming Procedures,Programming equipment Hand held programmer, Programming sequence , PLC Ladder Diagrams , Process scanning consideration , PLC operational fault. NOT ,AND, OR, NAND, NOR, Ex-OR, Ex-NOR logic, PLC Programming languages, Boolean algebraic equation, Holding (latching relay) contact, Branching and complex branching ladder rung. (10 hours)

PLC Applications to Industrial Problems

PLC programming using ladder logic for simple industrial applications--Temperature control, sorting a product, bottling plant, mixing two chemicals, level control. (6 hours)

Distributed Control System (DCS)

Introduction to DCS, History of DCS, Concept of DCS, Hierarchy of DCS, Functions of each level of DCS, Network topology for DCS, Display organization (Monitoring facilities) for DCS. (7 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Programmable logic Controllers Principles	John W. Webb, Ronald A Reis	PHI Learning
2	Programmable Logic Controllers-Programming methods and applications	John R Hackworth Frederick D. Hackworth Jr	Pearson
3	Process Control Principles and applications	SurekhaBhanot	Oxford University press
4	Industrial Electronics-Applications for Programmable Controllers, Instrumentation and Process Control, and Electrical Machines and Motor Controls	Thomas E Kissell	PHI Pvt. Ltd.
5	Instrumentation engineer's handbook	B.G Liptak	Chilton Book Co., Philadelphia
6	Process control Instrumentation technology	Curtis D Johnson	PHI Pvt. Ltd

Course Title	Programmable logic controller and distributed control system Lab		Credits	01
Course Code	EE-661	Max Marks-50	P	03

Note: At least eight experiments are to be performed.

List of Experiments:

1. Introduction to the various modules and components of PLC hardware.
2. Study and implementation of NOT, AND, OR, NAND & EX-OR logic gates using ladder diagrams with the help of PLC.
3. Develop ladder diagram for given car parking system using PLC.
4. Develop ladder diagram for working of DC motor using PLC.
5. Develop ladder diagram for given DOL(Direct on line) starter reverse /forward system using PLC.
6. Develop ladder diagram for given traffic light control system using PLC.
7. Develop ladder diagram for water level indicator system using PLC.
8. Develop ladder diagram for resistance welding system using PLC.
9. Develop ladder diagram for piston movement system using PLC.
10. Develop ladder diagram for given star delta connection system using PLC.
11. Study and identify various levels of Distributed Control System.

Course Title	**EE 612**
Course Code	**Signals & Systems**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Basic knowledge of Mathematics**
	1. To understand different types of Signals, Systems and their examples in real life situations. 2. To study solution of differential and difference equations. 3. To study Fourier Series and Fourier Transform of Continuous and Discrete time systems and using these tools to solve systems represented by differential and difference equations 4. To study Laplace Transform, Z-transform, their properties and their use in finding the output of LTI systems
Course Outcome (s)	1. Ability to analyze different types of continuous and discrete time systems 2. Ability to represent and analyze real world problems into differential and difference equations and solve them usingFourier series and Fourier transform 3. Ability to use Laplace Transform, Z-transform and Hilbert Transform to analyze and solve LTI systems.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION A

Signals & Systems

Classification of Signals, Dirac Delta function and properties, Transformations of independent variable, Elementary Signals, Continuous time and Discrete time systems, System Properties, Examples of Signals and Systems in Electrical, Mechanical, Hydraulic, Thermal, and Biomedical Systems. (5 Hours)

Linear Time Invariant Systems

Convolution sum and integral, Properties of LTI systems, Systems described by differential equations and difference equations, Singularity functions. (4 Hours)

Fourier series Representation

Response of LTI systems to complex exponentials, Fourier series representation of continuous time periodic signals, Convergence of fourier series, Properties of continuous time Fourier series, Fourier series representation of discrete time periodic signals, , Properties of discrete time Fourier series, Filtering, examples of filters described by differential and difference equations. (6 Hours)

The Continuous Time Fourier Transform

Fourier Transform of continuous time aperiodic signals, The Fourier transform for periodic signals, Properties of Continuous Time Fourier Transform.

(5 Hours)

Sampling

The sampling Theorem, Reconstruction using Interpolation, Aliasing (3 Hours)

SECTION-B

The Discrete time Fourier Transform

Fourier transform of discrete time aperiodic signals, The Fourier transform of periodic signals, Properties of Discrete time Fourier Transform, Duality, The magnitude-phase representation of the Fourier Transform, The magnitude-phase representation of the Frequency response of LTI systems. (7 Hours)

The Laplace Transform

Laplace Transform, ROC of Laplace Transform, The Inverse Laplace Transform, Pole-zero plot, Properties of Laplace transform, Characterization of LTI systems using Laplace Transform, Interconnection of LTI systems, The Unilateral Laplace Transform. (6 Hours)

The Z-Transform

The Z-Transform, ROC of Z-transform, The Inverse Z-Transform, Pole-Zero plot, Properties of Z- Transform, Characterization of LTI systems using Z-Transform, Interconnection of LTI systems, The Unilateral Z Transform. (6 Hours)

Hilbert Transform

Introduction to continuous-time and discrete-time Hilbert Transform (3 Hours)

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Signals and Systems	Oppenheim, A. V., Willsky , A.	Pearson
2	Principles of Linear Systems and Signals	B. P. Lathi	Oxford University Press
3	Signals and Systems	Haykin, S., Van Veen, B.	Wiley; 2003
4	Signal Processing & Linear Systems	B. P. Lathi	Oxford University Press
5	Signals and Systems	A. Rajeshwari, V. Krishnaveni	Wiley India
6	Signals and Systems	T. K. Rawat	Oxford University Press
7	Schuam's outline of Signals and System	Hsu, H.; Ranjan R	Tata McGraw Hill

Course Code	**EE-613**
Course Title	**Energy Management and Auditing**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Power Plant Engineering, Electric Motors and Power Electronics and Drives**
Course objectives	1. To understand the present Energy Scenario and Basics of various forms of Energy 2. To understand Energy Management, Action Planning, Financial Management and Audit. 3. To understand the Energy Monitoring and Targeting system, the Power Supply System and electric motors. 4. To understand the concept of Lighting System, Energy Efficient Technologies.
Course Outcome (s)	1 Students will understand about Energy scenario in world and India, Energy Conservation and its Importance, Energy Strategy for the Future, The Energy Conservation Act, 2001 and its Features. 2 Students will demonstrate an understanding of Energy Costs, Benchmarking. 3 Student will be able to learn about Energy Audit: Types and Methodology, Energy Audit Reporting Format, Energy Audit Instruments. 4 Students will be able to demonstrate Financial Analysis Techniques, Sensitivity and Risk Analysis and other financing options.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Energy Scenario and Basics of Energy

Energy scenario in world and India, Energy Conservation and its Importance, Energy Strategy for the Future, The Energy Conservation Act, 2001 and its Features, Various Forms of Energy, Electrical Energy Basics (6 hours)

Energy Management and Audit

Definition & Objectives of Energy Management, Energy Audit: Types and Methodology, Energy Audit Reporting Format, Understanding Energy Costs, Benchmarking and Energy Performance, Matching Energy Usage to Requirement, Maximizing System Efficiency, Fuel and Energy Substitution, Energy Audit Instruments. (6 hours)

Energy Action Planning and Financial Management

Introduction, Energy Management System, Introduction, Investment Need, Appraisal and Criteria, Financial Analysis, Financial Analysis Techniques, Sensitivity and Risk Analysis, Financing Options. Introduction and steps in Project Management.

(6 hours)

Energy Monitoring and Targeting

Definition, Elements of Monitoring & Targeting System, A Rationale for Monitoring, Targeting and Reporting, Data and Information Analysis, Relating Energy Consumption and Production, CUSUM, Case Study. (5 hours)

SECTION-B

Electrical System and Motors

Electrical Load Management and Maximum Demand Control, Power Factor Improvement and Benefits, Harmonics, Analysis of Electrical Power Systems Motor Selection, Energy Efficient Motors, Factors Affecting Energy Efficiency and Minimizing Motor Losses in Operation, Rewinding Effects on Energy Efficiency, Speed Control of AC Induction Motors, Motor Load Survey: Methodology.

(8 hours)

Lighting System

Introduction, Basic Terms in Lighting System and Features, Lamp Types and their Features, Recommended Illuminance Levels for Various Tasks/Activities/Locations, Methodology of Lighting System, Energy Efficiency Study, Case Examples, SomeGood Practices in Lighting.

(7 hours)

Energy Efficient Technologies in Electrical Systems

Maximum Demand Controllers, Automatic Power Factor Controllers, Energy Efficient Motors, Soft Starter, Variable Speed Drives, Energy Efficient Transformers, Electronic Ballasts, Energy Efficient Lighting Controls. (7 hours)

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	General Aspects of Energy Management and Energy Audit	V.S. Verma	Bureau of Energy Efficiency, II edition, 2005
2	Energy Efficiency In Electrical Utilities	V.S. Verma	Bureau of Energy Efficiency, II edition, 2005.

Course Title	Energy Management and Auditing Lab		Credits	01
Course Code	EE-663	Max Marks-50	P	03

Note: At least four experiments and a case study are to be performed.

List of experiments:

1.To obtain polar curve of a lamp.

2.To measure harmonics and do the analysis for any 3-phase system.

3.To measure the currents, voltages and active and reactive powers in a three phase system using energy auditor.

4.To design a lighting system for any auditorium/building/ hall.

5.To test a 3-phase machine of unknown rating.

Case Study:

To perform case study for energy audit of educational institute/ industrial unit/ administrative or commercial building and prepare a complete report suggesting the changes to be made.

a) Education Institute

b) Hostel

c) Library

d) Laboratories

Recommended Experiments (Beyond Curriculum):

1. To study energy auditor and its functions
2. To do the payback analysis of the recoomendations of energy audit done.
3. To study the tariff policy of the state electricity board (UT)/ Punjab/ Haryana.

Course Code	**EE- 606**
Course Title	**Power Electronics**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Basic fundamentals of Analog and Semiconductor Electronics**.
Course objectives	1. To provide the electrical circuit concepts behind the different working modes of power converters so as to enable deep understanding of their operation. 2. To equip with required skills to derive the criteria for the design of power converters starting from basic fundamentals. 3. To analyze and comprehend the various operating modes of different configurations of power converters. 4. To design different power converters namely AC to DC, and DC to DC converters
Course Outcome (s)	1. To be able to understand the thyristor and semi convertor power switching devices characteristics. And, also to understand concerned topics related to operation of thyristors useful for their industrial applications. 2. To be able to understand the various thyristor commutation techniques. 3. To be able to understand the theory, operation and control of single-phase and three-phase controlled rectifier, in detail because of its widespread use. 4. To be able to understand the theory, operation and control of DC to DC converters, in detail and design of its commutating components.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Thyristor and Semiconductor Power Switching Devices

Devices of Thyristor family and their V-I characteristics: Thyristor, DIAC, TRIAC, GTO, MOSFET, IGBT, Principle of operation of SCR, two transistor model of SCR. Turn on methods of a Thyristor, Switching characteristics of Thyristor during turn-on and turn-off, Gate characteristics, Thyristor triggering .

Series and parallel operation of SCR's, Thyristor specifications (latching current and holding current, dv/dt and di/dt etc.), Thyristor Protection circuits, UJT: characteristics and as a relaxation oscillator. (14 hours)

SCR Commutation Circuits

Thyristor commutation process, commutation circuits – natural & forced commutation – class A, B, C, D, E, F commutation - comparison of power devices.

(09hours)

SECTION-B

Phase controlled Rectifiers

Controlled rectifiers : single-phase half converter and full converters, analysis with R & RL loads, freewheeling diode effect, 3-phase half-wave – full converters & semi converters – analysis with R & RL loads, continuous conduction & discontinuous conduction, Inversion mode -effect of source inductance on 1-phase & 3-phase full converters – overlap angle - single-phase dual converters – circulating & non circulating current operation.

(12 hours)

DC-DC converters

Step-down chopper, step- up chopper , analysis with R & RL load –PWM, frequency modulation control – current limit control – Fourier analysis of output voltage - two-quadrant & four-quadrant chopper – voltage commutated chopper – current commutated chopper, buck, boost, buck-boost and cuk regulators, condition for continuous inductor current and capacitor voltage - design of LC filter – comparison of regulators.

(10 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Power Electronics	P.S.Bimbhra	Khanna Publishers, 11th Edition, 2003
2	Power Electronics Circuits, Devices and Applications	M.H Rashid	Prentice Hall India, 3rd Edition, 2004
3	Elements of Power Electronics	Philip T. Krein	Oxford University Press -1998
4	Modern Power Electronics	P.C. Sen	Wheeler Publishing Co, 1st Edition, New Delhi, 1998.

RECOMMENDED BOOKS

1	Power Electronics: converters, Application and design	Ned Mohan	John Wiley and sons. Wiley India edition, 2006.
2	Power Electronics	M.D. Singh and K.B Khanchandani	Tata McGraw Hill, 2001

Course Title	Power Electronics Lab		Credits	01
Course Code	EE-656	Max Marks-50	P	03

Note: At least eight experiments are to be performed.

1. To plot the V-I characteristics of the SCR.
2. To draw V-I characteristics of Triac.
3. Study of R and RC triggering circuits for SCR.
4. To study and perform the triggering of SCR circuit through UJT firing.
5. Study of SCR commutation circuits and check the performance of one commutation circuit.
6. Study of Jones chopper or any chopper circuit to check the performance.
7. Design and simulation of following of circuit in MATLAB / other software.
   a) Rectifier circuit with RL Load
   b) Three phase thyristor converter
8. To study the implementation of four quadrant operation of DC to DC convertor in DC machines using MATLAB/SIMULINK environment.
9. To plot the load voltage and thyristor voltage of single wave and full wave phase controlled rectifier.
10. To study the voltage and current commutated choppers.

Course Code	**DIC-02**
Course Title	**Sensors Based Application Systems**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Basic fundamentals of Analog and Semiconductor Electronics**.
Course objectives	1. Develop judgment of what sensors and modalities are appropriate for different applications 2. Know how to electronically condition the sensor, hook it up to a microcomputer, and process the signal (at least basically) 3. Have some idea of how/where these sensors were used before 4. Have a reasonable idea of how different sensors work
Course Outcome (s)	1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. Students are assigned both individual and group projects, which require ability to conduct simulation, analyze and interpret results. 4. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 5. An ability to function on multi-disciplinary teams. 6. An ability to identify, formulate, and solve engineering problems. Students are presented with engineering problems, like designing sensors for biomedical, automotive applications. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

Section-A

Basics: Sensors: examples and definitions, Introduction to Sensor Electronics and terminology (Fraden Ch. 2)

Strain Gauges: Basics and Examples (FradenCh 3.5, 5.1, 5.2, 5.7, 9)

Thermometers: Measurement Techniques and Examples, Flow Sensors (Fraden Ch. 16)

Radiation Sensors: Overview of Types, Examples of Applications (Fraden Ch. 14)

IR Sensors and Demo: IR Motion

Capacitive sensors: Fundamentals, Applications and Examples (Fraden Ch. 3.2, 6.3, 7.3, 10.6)

(22 hours)

Section-B

Accelerometers (Fraden Ch. 8)

Piezoelectric Sensors (Fraden Ch. 3.6, 5.2.4, 8.4)

Pressure sensors: Principles and Examples (Fraden Ch. 10)

Inductive and Magnetic Sensors (Fraden Ch. 3.3, 3.4, 7.4)

Active sounding: Methods for measurement, Examples

Chemical Sensors

Biosensors

RF sensors

Applications of sensors in Process Control, Biomedical Field, Automation, Transportation, Agriculture, Post-harvest supply chain and processing, Environment etc. (23 hours)

Project work.

Students will work on different problems from industries and come up with some practical solutions.

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	*Handbook of Modern Sensors*	Fraden, J	*Physics, Designs, and Applications*. 4th ed. Springer, 2010. ISBN: 9781441964656.
2	*The Art of Electronics*	Horowitz, P., and W	2nd ed. Cambridge University Press, 1989. ISBN: 9780521370950.

Year: Fourth **Semester: Seventh**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	EE-710	Power Electronic and Drives	3-1-0	4	4	50	50	100	-
2	EE-760	Power Electronic and Drives Lab	0-0-3	3	1	-	-	-	50
3	EE-711	Electrical Insulation in Power Apparatus & Systems	3-1-0	4	3	50	50	100	-
4	EE708	Digital Signal Processing	3-1-0	4	4	50	50	100	-
5	EE758	Digital Signal Processing Lab	0-0-3	3	1	-	-	-	50
6	EE-709	Elective-I	3-1-0	4	4	50	50	100	-
7	EE-705	Minor Project	0-0-6	6	3	-	-	-	100
8	EE-706	Seminar	0-0-2	2	1	-	-	-	50
9	EE-707	Vocational Training of Sixth Semester	0-0-2	2	1	-	-	-	50
Total			12-4-16	32	22	200	200	400	300

*Practical marks are for continuous and end semester evaluation

Elective-I

- ***(i) Electrical Traction***
- ***(ii) Electrical Power Generation***
- **(iii) *Electrical utilization and illumination***

COURSE CODE	**EE 710**
COURSE NAME	**Power Electronics and drives**
TYPE OF COURSE	**Core**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 **50** **50**
Course Prerequisites	**Power Electronics**
Course Objectives (CO)	1. To provide the electrical circuit concepts behind the different working modes of inverters so as to enable deep understanding of their operation. 2. To equip with required skills to derive the criteria for the design of power converters for UPS,Drives etc., 3. Ability to analyse and comprehend the various operating modes of different configurations of power converters.
Course Outcome	1. To be able to design different single phase and three phase AC converters. 2. To be able to select and design appropriate power drive circuits for various machines control applications.

SYLLABUS

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

Section-A

1. **AC Voltage Controllers**
   ON-OFF control – phase control – 1-phase full wave – analysis with R & RL load – input PF, two stage sequence control with R & RL load – 3-phase full-wave controller with R load,3-phase bidirectional delta connected controllers

   (8 hours)

2. **Inverters**
   Single-phase half bridge and full bridge – HF, THD, DF, Three-phase bridge inverter - 180º and 120º conduction, Analysis with R & RL load, PWM techniques – single pulse, multiple pulse & sinusoidal pulse width modulation, modulation index, voltage control of 1-phase inverters,

harmonic reduction, current source inverter, Series and parallel inverters, Mc-Murray Bedford inverters.

(10 hours)

3. Multi Level Inverters

Multilevel concept – diode clamped – flying capacitor – cascade type multilevel inverters

(5 hours)

SECTION-B

4. Cycloconverters

Principle of operation, Single phase and Three-phase Dual converters, Single phase and three phase cyclo-converters, power factor Control, Advantages disadvantages of cycloconverters

(10 hours)

5. Electric Drives

Concept and Components of electrical Drives ,DC Drives-Single phase & three phase, Chopper drives-motoring control,regenerative braking,two quadrant & Four quadrant chopper drives, Induction motor drives-Stator voltage, Stator Frequency, Stator current control, Industrial applications of DC and AC Drives.

(12 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Power Electronics	P.S.Bimbra	Khanna Publishers, 11th Edition, 2003
2	Power Electronics Circuits, Devices and Applications	M.H Rashid	Prentice Hall India, 3rd Edition, 2004.
3	Modern Power Electronics	P.C. Sen	Wheeler Publishing Co, 1st Edition, New Delhi, 1998.
RECOMMENDED BOOKS			
1	Modern Power Electronics and AC Drives	BimalK.Bose	Pearson Education, 2nd Edition, 2003.
2	Power Electronics: converters, Application and design	Ned Mohan, T.M. Undeland and W.P Robbin	John Wiley and sons. Wiley India edition, 2006
3	Fundamentals of Electrical Drives	GobalK.Dubey	Narosal Publishing House, New Delhi, 2nd Edition ,2009

Course Title	Power Electronics And Drives Lab		Credits	01
Course Code	EE-760	Max Marks-50	P	03

Note: At least eight experiments are to be performed selecting at least three from experiment 7.

1. Thyristorised speed control of a d.c. Motor.
2. Speed control of induction motor using thyristor.
3. Study of series inverters and check their performance.
4. Study of mc murray half-bridge inverters and check their performance
5. Study of the microprocessor based firing control of a bridge converter.
6. To design and simulate the 1-phase ac controller and analyze the results
7. Design and simulation of Inverter circuits using pscad / matlab software.
8. To design and simulate DC-DC drives.
9. To design and simulate DC-AC drives.
10. Study of single phase to single phase cycloconverter using Matlab.

Course Code	**EE711**
Course Title	**Electrical Insulation in Power Apparatus & Systems**
Type of Course	Core
L T P	3 1 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Dielectrics Materials
Course Objectives (CO)	1. To understand the role of insulation in power system. 2. To be competent in understanding the properties of the materials and their failure mechanisms during service.
Course Outcome	1. Students will be confident in calculating insulation level of power apparatus. 2. Students will be able to apply various insulation levels testing in real applications also.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Introduction: Role of the insulation in power apparatus and systems, essential properties of dielectrics. Insulating materials commonly used in power system equipment: review. (7hours)

Breakdown Mechanism: Breakdown mechanisms in gases, Breakdown mechanisms in liquids, breakdown mechanisms in vacuum, Breakdown mechanisms in solids. Partial discharge. Basic electrical design concepts, Principles of insulation coordination, Ageing mechanisms. (16hours)

SECTION-B

Insulation defects in power system equipment. Insulation testing basics.Testing of power apparatus .Generation of high voltages.Measurement of high voltages. Condition monitoring of power apparatus, New advanced techniques in diagnosis and monitoring. (16hours)

Nanodielectrics: brief overview (6hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Advances in high voltage engineering	A. Haddad and D. Warne	IEEE Power and Energy Series, 2004.
2	Electrical Insulation in Power Systems	N.H.Malik, A. A. Al-Arainy and M. I. Qureshi	Marcel Dekker, 1997
3	Insulation of High Voltage Equipment	V.Y. Ushakov, Springer-Verlag	Springer-Verlag, 2004.
4	High Voltage Engineering Fundamentals	KuffelZaengelKuffel,	Newnes.
ADDITIONL READINGS			
1	IEEE Transactions on Dielectrics and Electrical Insulation: select papers		
2	Insulation Magazine (IEEE): select papers	Govind P. Agrawal	third edition, Wiley India

Course Code	**EE708**
Course Title	**Digital Signal Processing**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Basic knowledge of Mathematics**
Course objectives	1. To introduce the concept of different types of signals and systems. 2. To introduce Fourier series, Fourier Transform, Z-Transform, Discrete Fourier Transform and Fast Fourier Transform of signals. 3. To introduce the concept of various designing techniques for FIR and IIR filters. 4. To introduce the architecture, addressing mode and memory of TMS320C5X DSP processors
Course Outcome (s)	7. Familiarity with fundamental concepts such as 'linearity' , 'time-invariance', 'impulse response', 'convolution', 'frequency response', 'z-transforms' and the 'discrete time Fourier transform'. as applied to signal processing systems. 8. Understand the discrete Fourier transform (DFT), its applications and its implementation by FFT techniques. 9. Understand how FIR and IIR type digital filters: may be designed and implanted in software. 10. Specify the "real time" implementation of DSP operations using TMS320C5X DSP processors.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION A

1. Introduction

Basic Elements of Digital Signal Processing Systems, Need and advantages of Digital Signal Processing; Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; Sampling Theorem, Practical sampling. (8 hours)

2. Discrete Time System Analysis

Linear Time Invariant systems, Stability and Causality, Solution of Linear constant coefficient difference equations, Convolution, Correlation, Z- Transform and its properties, Inverse Z transform, Solution of difference equation using Z-Transform (7 hours)

3. Frequency Domain Representation of Signals and Systems

Fourier series & Fourier Transform of Discrete time signals, Discrete Fourier Transform and its properties, Fast Fourier Transform, Decimation in time and Decimation in frequency algorithms. Frequency domain representation of discrete time systems . (8 hours)

SECTION B

4. Design of Digital Filters

Fundamentals of filter design, Design of FIR Filters**:** Window technique, Frequency sampling technique IIR Filters**:** Analog filter approximations - Butterworth, Chebyshev and Elliptic filter, Design of IIR Digital filters from analog filters,IIR Filter Design by Impulse Invariance & Bilinear transformation ,Frequency transformation in analog and digital domain

(12 hours)

5. Implementation of Discrete Time Systems

Block diagrams and signal flow graphs for FIR and IIR systems. Direct form, Cascade and Frequency Sampling Structures for FIR systems, Direct forms, Cascade and Parallel form realization of IIR systems, Finite Word Length Effects. (5 hours)

6. DSP Processors

Introduction to DSP architecture - Harvard architecture, TMS320C5X Architecture, Instruction set, Memory and Addressing Modes. (5 hours)

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Signal Processing: Principles, Algorithms and Applications	Proakis&Manolakis	Fourth Edition by Pearson Education Ltd.
RECOMMENDED BOOKS			
1	Digital Signal Processing	E C Ifeacher and B W Jervis	
2	Digital Signal Processing A Modern Introduction	Ashok Ambardar	Thomson
3	Digital Signal Processing	A.V Oppenheim and R.W.Schafer	Pearson Education Ltd
4	Digital Signal Processing	Sanjit K. Mitra	Tata Mcgraw Hill
5	Digital Signal Processing	S Salivahanan, A Vallavraj, C Gnanapriya	Tata Mcgraw Hill.

Course Title	Digital Signal Processing lab		Credits	01
Course Code	EE-758	Max Marks-50	P	03

List of Experiments:

1. Introduction to MATLAB.
2. Effect of noise on signals in MATLAB.
3. Z-Transform.
4. Convolution of sequences in MATLAB.
5. Correlation of sequences in MATLAB.
6. Detection of Signals buried in Noise.
7. System Response to Arbitrary Inputs.
8. DFT & IDFT of two sequences.
9. FFT of two Sequences.
10. Circular Convolution.
11. ovelap-add method and overlap-save methods.
12. FIR Filter Design in MATLAB.
13. IIR Filter Design in MATLAB.
14. Interpolation and Decimation of sequences.
15. Implementation of digital filter banks.
16. System Design based on DSP kits.

Course Code	**EE-709 (i)**
Course Title	**Electric Traction**
Type of Course	Elective-I
Credits	4
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 50 50
Course Pre-requisites	-
Course objectives	1. To understand the basics of traction systems 2. To be competent in understanding the various traction motors and their control 3. To learn about various electric locomotives, their auxiliary apparatus 4. To understand feeding and distribution systems pertaining to tractions
Course Outcomes	1. Distinguish different traction systems and latest trends in traction systems. 2. Differentiate services of traction system based on speed time curve. 3. Control different types of traction motors Use various traction system auxiliaries. 4. Explain the distribution system of a traction system.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION -A

Basics of traction systems

Electric traction, Advantages of electric traction, Different systems of electric traction, DC and AC systems, diesel electric system, types of services – urban, sub-urban, and main lines and their speedtime curves,Choice of traction system - Diesel- Electric or Electric. (12 hours)

Traction motors and their control

Features of traction motors, Significance of D.C. series motor as traction motor, A. C. Traction motors-single phase, Three phase, Linear Induction Motor, Comparison between different traction motors, Series-parallel control, Open circuit, Shunt and bridge transition, Introduction to EMU and metro railways. (11 hours)

SECTION-B

Electric locomotives and their auxillary equipment

Important features of electric locomotives, Different types of locomotives, Current collecting equipment, Coach wiring and lighting devices, Power conversion and transmission systems, Control and auxiliary equipment, Electrical block diagram of an electric locomotive with description of various equipment and accessories. (14 hours)

Feeding and distribution system

Distribution systems pertaining to traction (distributions and feeders), Traction sub-station requirements and selection, Method of feeding the traction sub- station. (8 hours)

Reference Books

Sr	Title	Author	Publication
1	Modern Electric Tractio	H. Partab	DhanpatRai and Sons, New Delhi
2	Electric Traction	J. Upadhyay S. N. Mahendra	Allied Publishers Ltd., DhanpatRai and Sons, New
3	Electric Traction	A.T. Dover	Mac millan, DhanpatRai and Sons, New Delhi
4	Electric Traction Hand Book	R. B. Brooks	Sir Isaac Pitman and sons ltd. London

Course Code	**EE-709(ii)**
Course Title	**Electric Power Generation**
Type of Course	Elective-I
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Power systems
Course Objectives (CO)	1. To understand the role of load curves in energy calculations. 2. To be competent in understanding the various costs involved in electric power generation. 3. To learn about various methods of tariff calculations for different type of consumers.
Course Outcome	1. Students will be confident in finding cost of power plant in real life. 2. Students will be able to analyze the load curves of the system. 3. Students will be competent to analyze tariff plans executed in power sector.

SYLLABUS

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

SECTION-A

Introduction: Electrical energy sources, organization of power sector in India, single line diagram of thermal, hydro and nuclear power stations.

(6 hours)

Loads and Load curves: Maximum demand, Group diversity factor, Peak diversity factor, Types of load, chronological load curves, load-duration Curve, mass curves, load factor, capacity factor, utilization factor, base load and peak load plants, load forecasting.

(8 hours)

Tariffs and power factor improvement: Objectives of tariff making, different types of tariff for domestic, commercial, agricultural and industrial loads. Need for p.f. improvement, p.f. improvement using capacitors, determination of economic p.f.

(8 hours)

SECTION-B

Power Plant Economics: Capital cost of plants, annual fixed cost, operating costs and effect of load factor on cost of energy, depreciation.

(7 hours)

Selection of plant: Plant location, plant size, no. and size of units in plants, economic comparison of alternatives , annual cost , rate of return, present worth and capitalized cost methods.

(9 hours)

Hydro-thermal co-ordination: Advantages combined working of run off river plant and steam plant, reservoir hydro plants and thermal plants-long term operational aspects, scheduling methods.

(7 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Power System Engineering	A. Chakrabarti, M. L. Soni, P. V.Gupta, U.S. Bhatnagar.	Dhanpat Rai And Company Private Limited.
2	Power Plant Engineering	Dom Kundwar	Dhanpat Rai And Company Private Limited
3	Power Plant Engineering	R K Rajput	Laxmi Publication
4	Generation of Electric Energy	B.R. Gupta	S.Chand Publishers

Course Code	**EE-709(iii)**
Course Title	**Electrical utilization and illumination**
Type of Course	Elective-I
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	**Basic electrical energy and electrical machine**
Course Objectives (CO)	1. To learn basic utilisation electrical energy 2. To understand different types of drives electrical. 3. To get the basics of illumination, heating, welding and air conditioning.
Course Outcome	1. Students will apply knowledge for better utilization of electrical energy. 2. Students will understand different way of illumination, heating, air conditioning 3. Students understand the application of the electrolysis.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Electric Drives: Electrical drives & Mechanical drives, Concept of electrical drives, Basic features of industrial drives, review of operating and starting characteristics of different types of electric motors for various drives (AC and DC motors). Estimation of rating and heating of motors, Load equalization (Fly wheel effect), Drives for particular services. (10 hours)

Electric Traction: Introduction to Indian railways system , Electric Locomotive Classes, Various types of Traction system, single phase feeding arrangement prevalent in India. Substation. arrangements, Different Types of Catenary construction and line insulation, Span and dropper design Calculations. (12 hours)

SECTION-B

Electric Heating and Welding: Methods of electric heating, types of electric heating, constructional details and performance of resistance heating furnace. Dielectric heating, Alternating current (AC).and Direct current (DC) Welding, Resistance and Arc Welding. Electric Beam Welding, Laser Welding. Typical construction of electrical welding AC and DC set. (7 hours)

Illumination: Production of light by different methods, terms used, laws of illumination, Different Artificial light sources, their construction and operating principles, Design of lighting schemes and equipment used for indoor, industrial and flood lighting. (6 hours)

Refrigeration and Air conditioning: Refrigeration system, Domestic refrigeration, Air conditioner, Comfort Air conditioning, Effective temperature. (5 hours)

Electrolysis: Laws of Electrolysis, Process voltage, current, energy, efficiency, Applications of electrolysis. (5 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Modern Electric Traction	Partab H	Dhanpat Rai
2.	Electric Energy Utilization and Conservation	Tripathy S. C	Tata McGraw Hill
RECOMMENDED BOOKS			
1	Electric Drives	De N.K. and Sen P.K	PHI publication
2	Utilization of Electric Power and Electric Traction	Gupta J.B	S.K. Kataria and Sons

Year: Fourth **Semester: Eighth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	EE-801	Non – Conventional Energy Sources	3-1-0	4	4	50	50	100	-
2	EE-809	Wireless Communication	3-1-0	4	4	50	50	100	-
3	EE-859	Wireless Communication(Lab)	0-0-3	3	1	-	-	-	50
4	EE-808	Elective –II	3-1-0	4	4	50	50	100	-
5	EE-810	Elective –III	3-1-0	4	3	50	50	100	-
6	EE-805	Major Project	0-0-6	6	6	-	-	-	100
Total			12-4-9	25	22	200	200	400	150

A student can exercise Option I and Option II according to the following:

Option-I

Elective-II

- ***(i) Electrical Machine Design***
- ***(ii) High Voltage AC-DC***
- ***(iii) FACTS***
- ***(iv) Embedded System Design***

Elective-III

- ***(i) Entrepreneurship and Project Management***
- ***(ii) Financial Management***
- ***(iii)Marketing Management***
- ***(iv)Cyber Laws and IPR***

Option-II

Industrial Training EE-850 Total Marks-550

Option II							
S.No	**Course Code**	**Course Name**	**Duration**	**Credits**	**Scheme of Examination**		
					Practical		
					Internal Assessment	**University Assessment**	**Total**
1	EE-850	Industrial Training	6 Months	22	250	300	550

A student may opt for one semester training in lieu of subjects of 8th Semester. The marks for six months training will be equal to the total marks of 8th Semester study. A student can opt for six month training under following conditions:-

a) The student got selected for job in campus placement and the employer is willing to take that student for the training.
b) The student got offer of pursuing training from reputed government research organization/govt. sponsored projects/govt. research institution provided that student should not be paying any money to get trained. For pursuing this training student needs the prior approval from the Chairperson/Coordinator of the respective branch.

Course Code	**EE-801**
Course Title	**Non-Conventional Energy Sources**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Power Plant Engineering and Energy Management and Auditing**
Course objectives	1. To understand the limitation of conventional energy sources, need and growth of alternative energy source. 2. To understand the thermoelectric generators, MHD generator, their applications and economic aspects. 3. To understand photovoltaic cells, fuel cells, their characteristics, solar batteries, solar collectors, solar furnaces and their applications. 4. To understand geothermal, hydro, wind and tidal energy resources
Course Outcome (s)	1. Students will understand about limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation. 2. Students will demonstrate an understanding of Basic principle of MHD generator, thermoelectric generators, their types, applications and economic aspects. 3. Students will be able to demonstrate photovoltaic effect, different types of photovoltaic cells, characteristics of photovoltaic cells, solar batteries, solar collectors, solar furnaces and their applications. 4. Students will understand about fuel cells, their types, characteristics and application. 5. Students will be able to demonstrate geothermal system, their characteristics, hydro-plants, wind energy and tidal energy.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

1. Introduction

Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.

(4 hours)

2. MHD Generators

Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of MHD generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.

(6 hours)

3. Thermo-Electric Generators

Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect.

(7 hours)

4. Photo Voltaic Effect And Solar Energy

Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.

(6 hours)

SECTION-B

5. Fuel Cells

Principle of action, Gibb's free energy, general description of fuel cells, types, construction, operational characteristics and application. (10 hours)

6. Miscellaneous Sources

Geothermal system, characteristic of geothermal resources, choice of generator set, electric equipment precautions low hydro-plants, definition of low head hydrometer, choice of site, choice of turbine wind power, history of wind power, wind machines, theory of wind power, characteristic of suitable wind power site, tidal energy, idea of tidal energy, tidal electric generator. (12 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Non Convential Energy Sources	G. D. Rai	Khanna Publishers.
2	Power System Engineering	A Chakrabarti, M. L. Soni,	DhanpatRai& Co.
3	, Generation of Electrical Energy	B. R. Gupta, S. Chand .	

Course Code	**EE-809**
Course Title	**Wireless Communication**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Knowledge of Communication Engineering .**
Course objectives	1. To become familiar with the existing and emerging wireless communication systems and standards. 2. To introduce the concept of frequency reuse and understand various methods for improving coverage and capacity in wireless communication systems. 3. To understand different modulation schemes, multiple access techniques and diversity techniques used in wireless communications. 4. To understand functions and operational principles of the various components of wireless networks.
Course Outcome (s)	1. Understand the fundamentals as well as the new research developments in the field of wireless communication 2. Gain insights into how diversity afforded by radio propagation can be exploited to improve performance. 3. Gain knowledge and awareness of the technologies used in Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Global system for Mobile (GSM) and WiFi Networks. 4. Gain the experience of working in a group towards a final project that will involve experiments, analysis and the design of exemplary wireless communication techniques and/or systems.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION A

1. **Introduction**

Evolution of Mobile Communication Systems, Paging systems, cordless telephone systems, cellular telephone systems, comparison of common wireless communication systems, 2G cellular

networks, 2.5 G wireless network, HSCSD, GPRS, EDGE technology, 3G wireless network, UMTS, 3G CDMA2000, 3G TD-SCDMA, 4G networks, WiMAX standard, LTE standard, Wireless Local Loop, Blue tooth and Personal Area Networks

(8 hours)

2. Cellular System Design Fundamentals

Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, Near for problems, power control, improving coverage and capacity in cellular systems, parameters for mobile multipath channel, Small scale fading.

(7 hours)

3. Modulation Techniques

Wireless Modulation technique and hardware, Characteristics of air interface, Path loss models, wireless coding techniques, Digital modulation techniques and Spread Spectrum Modulation techniques (8 hours)

SECTION B

4. Diversity Techniques for Mobile Radio Systems

Dispersive channels, space diversity, frequency diversity, Polarization diversity, Hybrid and quadruple diversity, RAKE receiver, Equalizer techniques. Fundamentals of channel coding.

(5 hours)

5. Overview of Multiple Access Techniques

Simplex, Duplex TDD and Time Division Duplex, Time Division Multiple Access (TDMA), FDMA ,Orthogonal Frequency Division Multiplexing(OFDM)and CDMA .

(5 hours)

6. Wireless Networking

Difference between wireless and fixed telephone networks, Development of wireless networks, Common Channel signaling, Broad band ISDN & ATM, Signaling System No.7(SS-7).

(5 hours)

7. Wireless Systems and Standards

Global system for Mobile (GSM); Services, Features, System Architecture and Channel Types, Frame Structure for GSM, CDMA Digital standard (IS 95); Frequency and Channel specifications, Forward CDMA Channel and Reverse CDMA channel, CT2 Standard for Cordless Telephones, Personal Access Communication System. (7hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Wireless Communications Principles and practice	Theodore S. Rappaport	Prentice Hall India, Edition 2nd
RECOMMENDED BOOKS			
1	Modern Wireless Communications	Simon Haykin ,	PHI,Edition Latest
2	Wireless Communication and Networking	Jon W Mark	PHI,Edition Latest
3	Mobile Radio Communication by Steele	Steele R., Hanzo L.	Wiley, 2nd Edition

Course Title	Wireless Communication Lab		Credits	01
Course Code	EE- 859	Max Marks-50	P	03

List of Experiments

1. To study the block diagram of mobile phone trainer kit.
2. To study and measure charging phenomena in mobile phone trainer kit.
3. To study and analyze vibrator in mobile phone trainer kit.
4. To study and analyze buzzer in mobile phone trainer kit.
5. To study the SIM card detection in mobile trainer kit
6. To study GSM trainer kit.
7. To study and perform AT commands in GSM trainer kit.
8. To prepare a project based on wireless communication

Course Code	**EE-808 (i)**
Course Title	**Electrical Machine Design**
Type of Course	**Elective-II**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Basic of transformer, Alternator and Induction motors.**
Course objectives	1. To understand the role of machine design for engineers. 2. To understand the steps of a transformer design. 3. To understand the steps of an induction motor. 4. To understand the steps of an alternator design.
Course Outcome (s)	1. Student will be able to design a transformer, induction motor and alternator while selecting its material and its various components for a given size. 2. Students can design transformer, alternator and induction motor for projects/real time applications.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

1. **Principles of design of Machines**

Specific magnetic and electric loadings output, Real and apparent flux densities, temperature rise calculation, Separation of main dimension for DC machines, Induction machines and synchronous machines.

(8 hours)

2. **Heating cooling and ventilation**

Cooling of machines, types of ventilation, continuous and intermittent rating.

(4 hours)

3. **Design of Transformers**

General considerations, output equation, emf per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling tubes, calculation of losses, efficiency and regulation, forces winding during short circuit.

(10 hours)

SECTION-B

4. **Three Phase Induction Motors:** General considerations, output equation, choice of specific electric and magnetic loadings, efficiency, power factor, number of slots in stator and rotor, elimination of harmonic torques, Design of stator and rotor winding, slot leakage flux, leakage reactance, equivalent resistance of squirrel cage rotor, magnetizing current, efficiency from design data.

(12 hours)

5. Alternators

Types of alternators, comparison, specific loadings, output co-efficient, design of main dimensions.

(8 hours)

6. Introduction to Computer Aided Electrical Machine Design**.**

(3 hours)

TEXT BOOKS

1	The Performance and Design of D.C. machines	A.E Glayton	PITMAN (ELBS).
2	The Performance and Design of A.C. Machines	M.G Say	PITMAN (ELBS).
3	Electrical Machine Design	A.K Sawhney	(DhanpatRai& Sons).

Course Code	**EE-808 (ii)**
Course Title	**High Voltage AC-DC**
Type of Course	**Elective-II**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	**Basic of transformer, Alternator and Induction motors.**
Course objectives	1. To introduce the need and concepts of HVDC. 2. To understand the selection of various components in HVDC system. 3. To understand the concept of generation of impulse voltage. 4. To understand the HVDC measurement and testing.
Course Outcome (s)	1. Students can understand importance of HVDC and its components. 2. Students can design circuits for impulse generation. 3. Students can understand the testing of generated voltage.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

1. Introduction

Introduction of DC Power transmission technology – Comparison of AC and DC transmission- Application of DC transmission – Description of DC transmission system– Planning for HVDC transmission – Modern trends in DC transmission.

(7hours)

2. Analysis of HVDC Converters

Pulse number – Choice of converter configuration – Review of Graetz circuit – valve rating, Transformer rating, Simplified analysis of Graetz circuit, without overlap only,Principles of DC link control, converter bridge characteristics – Characteristics of a twelve pulse converter – Detailed analysis of converters.

(10 hours)

3. Harmonics And Filters

Sources of harmonics in HVDC systems – Smoothing reactors – Corona and radio interference effects – harmonic distortion factor, types of AC filters, DC filters.

(6 hours)

SECTION-B

4. Generation of Impulse Voltage And Current

Introduction to standard lightning and switching impulse voltages, analysis of single stage impulse generator, expression for output impulse voltage, multistage impulse generator, components of multistage impulse generator, generation of switching impulse voltage, generation of high impulse current. (8 hours)

5. Measurement Of High Voltages

Chubb for HVAC measurement. Standard sphere gap measurements of HVAC, HVDC and impulse voltages, Factors affecting the measurements, Surge current measurement Klydanograph and magnetic links. (6 hours)

6. Non-Destructive Insulation Testing Techniques

Dielectric loss and loss angle measurements using Schering Bridge, transformer ratio Arms Bridge, need for discharge detection, factor affecting the discharge detection, discharge detection methods-straight and balanced methods. (8 hours)

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	High Voltage Engineering	.S.Naidu and Kamaraju	3rd Edition, THM, 2007
2	High Voltage Engineering	C.L.Wadhwa	New Age International Private limited, 1995
3	HVDC power transmission system	-Padiyar, K. R	Wiley Eastern Limited, New Delhi 1990. First edition.
4	Direct Current Transmission	Edward Wilson Kimbark	Wiley interscience, New York, London, Sydney, 1971.
RECOMMENDED BOOKS			
1	Extra High Voltage AC Transmission Engineering	Rakosh Das Begamudre	Wiley Eastern limited, 1987.
2	High Voltage Technology	L. L. Alston	BSB Publication, 2007.

Course Code	**EE-808 (iii)**
Course Title	**FACTS**
Type of Course	**Elective-II**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 **50** **50**
Course Prerequisites	Power systems, Power Electronics
Course Objectives (CO)	1. To understand the working conventional control mechanism and reactive power flow in a power system. 2. To understand the working and concept of static series, shunt and combined compensators.
Course Outcome	1. To apply the concepts of facts devices to power systems. 2. Selection of a particular fact device for power system application.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION-A

Introduction

Electrical transmission networks, Conventional control mechanisms, Introduction to FACTS.

(6 hours)

Reactive Power Control in Electric Transmission Systems, Loading Capability and Stability Considerations. related concepts and system requirements. (7 hours)

Static Compensators and Regulators (shunt)

Principles of operation, control schemes and characteristics of shunt compensators like SVC and STATCOM;

(10 hours)

SECTION-B

Principles of operation, control schemes and characteristics of series compensators like GCSE, TSSC, TCSC and SSSC; (10 hours)

Voltage and phase angle regulators like TCVR and TCPAR; (7 hours)

Combined compensators like UPFC (5 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Understanding FACTS	N.G Hingorani, J Gyugi	JEEE Press
2	Thyristor Based FACTS Controller for Electric Transmission Systems	R Mathur & P.K Verma	IEEE Press (Wiley)
RECOMMENDED BOOKS			
1	Flexible AC Transmission Systems (FACTS)	Y.H.Song	JEEE Press
2	Reactive Power Control in Power Systems	TSE Miller	-

Course Code	**EE-808 (iv)**
Course Title	**Embedded System Design**
Type of Course	**Elective-II**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 **50** **50**
Course Prerequisites	**Introduction to Micro controllers**
Course Objectives (CO)	1. To impart knowledge on embedded hardware and software. 2. To learn about architecture, programming, application and interfacing of Cortex-M0 ARM processor. 3. To study various types of software architectures and tools used in embedded system. 4. To learn about RTOS, operating system and MCU peripheral services.
Course Outcome	1. Understand the fundamentals of embedded hardware and software 2. Understand the fundamentals and programming of Cortex-M0 ARM processor which is a latest ARM® embedded processor with 32-bit performance. 3. Gain the knowledge of designing RTOS such as RTOS using Keil RTX, Free RTOS,MC/OS-II. 4. Gain the experience of working in a group towards a final project that will involve the use of Cortex-M0 (NU-LB-NUC140) learning board.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

PART A

1. Introduction to Embedded Hardware and Software

Terminology – Gates – Timing diagram – Memory – Microprocessor buses – Direct memory access – Interrupts – Built interrupts – Interrupts basis – Shared data problems– Interrupt latency, RISC Machines, ARM family history

(8 hours)

2. Cortex-M0 MCU Architecture and Programming

Cortex-M0 MCU (NUC140): Architecture ,Instruction Set, Thumb Instruction Set, Interrupt handling mechanism , Instruction cycle timings , Development tools and 'C'compiler programming.

(8 hours)

3. **Cortex-M0 MCU (NU-LB-NUC140) Application and Interfacing**

GPIO, A/D converter, LCD Interfacing, SD card interface, keypad matrix USB and CAN 2.0

(7 hours)

PART B

4. Software Development and Tools

Software architectures, Round – Robin, Round-Robin with Interrupts, Function Queue Scheduling architecture, Introduction to assembler – Compiler –n Cross compilers and Integrated Development Environment IDE, Linker/ Locators, Simulators, Getting Embedded software into target System Debugging Strategies.

(8 hours)

5. **Introduction to Real Time Operating Systems**

Task And Task States, Tasks and Data, Semaphores and shared data, Interrupt Routines in an RTOS Environment, Basic Design Using RTOS,RTOS using Keil RTX, Free RTOS,MC/OS-II

(8 hours)

6. Operating System and MCU Peripheral Services

Message queues, Mailboxes and Pipes, Timer Function, Events, Memory Management and peripheral services

(6 hours)

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Text books:

1. An Embedded Software Primer, by David E. Simon, Pearson Education, Latest Edition.
2. Steve Furber: ARM System-on-Chip Architecture, 2nd Edition, Addison-Wesley, 2000

Other books:

1. David Seal (Editor): ARM Architecture Reference Manual, 2ndEdition, Addison-Wesley, 2001.
2. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.
3. Ramani Kalpathi : ARM Based system design ,Sigma Publication, Chennai, 2013

Andrew N. Sloss, Dominic Symes, Chris Wright: ARM System Developer's Guide –Designing and Optimizing System Software,Elsevier, 2004.

Course Code	**EE-810(i)**
Course Title	**Entrepreneurship and Project Management**
L T P	**3 1 0**
Type of Course	**Elective III**
Credits	**3**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	-
Course objectives	1. The main aim of this course is to make prospective engineers familiar with the concept of entrepreneurship and MSMEs. 2. To provide knowledge about different aspects to be considered while formulating the business plan for a new entrepreneurial venture. 3. This course also intends to create awareness among students about financial and marketing functions that is required for a new venture.
Course Outcome (s)	1. The students will be able to apply engineering knowledge effectively in the field of entrepreneurship development 2. The students can make effective use of entrepreneurial knowledge to start and manage their venture 3. The students will learn to check the feasibility of a new project to maintain its long run sustainability.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION- A

Introduction to Entrepreneurship

Concept of Entrepreneurship, Characteristics and Functions of Entrepreneur Forms of Ownership of Business, Factors Affecting Entrepreneurship Case Studies of Entrepreneurs (7 hours)

Women Entrepreneurship

Nature of Women Entrepreneurship, Problems of Women Entrepreneurs, Institutional Initiatives for Promotion of Women Entrepreneurs (4 hours)

Micro, Small and Medium Enterprises (MSMEs)

Concept of MSMEs, Schemes of MSMEs Functions of Entrepreneurial Development Programmes (EDPs) (5 hours)

Project Identification

Idea Generation, Project Life Cycle, Concept of SWOT Analysis SWOT Analysis of Selected Project (4 hours)

SECTION-B

Project Planning and Formulation

Elements of Project Formulation: Product, Technical (Location, Scale, Technology, Production Process, Layout, Manpower, Resources), Market, Finance and Economic Aspects Feasibility Analysis: Financial Viability and Profitability, and Socio-Economic Desirability (9 hours)

Project Report

Formulation of Business Plan and Project Report, Hypothetical Example of a Real-Life Project (4 hours)

Finance and Marketing Function

Concept of Finance, Finance Related Terminologies, Sources of Finance, Cost Estimations Marketing Mix: Product, Place, Price, Promotion, People, Process and Physical Evidence Marketing Segmentation Targeting and Positioning (6hours)

Discussions on Additional Reading (any one of the following in the semester)

- The New Age Entrepreneurs
- The $100 Startup: Fire your Boss, Do what you Love and Work Better to Live More
- A Guide to Entrepreneurship
- Dhandha: How Gujaratis Do Business
- Rokda: How Baniyas Do Business
- Take Me Home
- Business Families of Ludhiana (4 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Dynamics of Entrepreneurial Development & Management	Desai V	5th Edition, Pubs: Himalaya Publishing House.
2	Projects: Planning, Analysis, Selection, Financing, Implementation and Review	Chandra P.	Edition, Pubs: McGraw-Hill Education (India).(2014)
3	Entrepreneur's Toolkit	Harvard Business School University Press.	Pubs: Harvard(2014)
4	Entrepreneurship	Hisrich R.D., Peters M.P. and Shepherd D.A	Pubs: McGraw Hill Education.(2014)
5	Essentials of Project Management	Ramakrishna K	Pubs: PHI Learning.
6	Entrepreneurship	Roy R	2nd Edition, Pubs: Oxford University Press 2011
7	Entrepreneurship Development in India	Gupta C.B. and Srinivasan N.P	Sultan Chand and Sons(2013)

Course Code	**EE-810(ii)**
Course Title	**Financial Management**
L T P	**3 1 0**
Type of Course	**Elective III**
Credits	**3**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	-
Course objectives	The main aim of this course is to make students learn different financial decisions i.e. investing, financing and dividend, required to be taken by a company and provide knowledge about the functioning of the financial system (financial markets, financial institutions, financial services and financial instruments) of the country.
Course Outcome (s)	The students will learn to make best combination of financial decisions by considering risk and return trade-off. The students will identify how business can gain maximum through the financial system. The students will understand how to manage funds effectively so as to maximize returns.
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION- A

Introduction to Financial Management

Concept of Finance, Terminology Related to Finance, Financial Decisions, Factors Affecting Financial Decisions, Risk-Return Trade-Off (5hours)

Financial System

Concept and Role of Financial System in Indian Economy (5 hours)

Financial Markets and Instruments

Concept and Relevance of Money Market and Capital Market

Money Market Instruments: Call Money, Treasury Bills, Commercial Papers, Certificate of Deposits

Capital Market Instruments: Equity Shares, Preference Shares and Debentures

Hypothetical Trading in Financial Markets (5 hours)

Financial Services

Nature and Functions of Financial Services: Merchant Banking, Mutual Funds, Factoring, Forfaiting, Credit Rating

Case Study on Financial Services (6 hours)

Financial Institutions

Nature and Functions of Financial Institutions: Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Discount and Finance House of India (DFHI) (2 hours)

SECTION- B

Long Term Investment Decisions

Capital Budgeting: Concept, Importance, Factors

Techniques/Methods with Numerical Applications (Pay Back Period, Accounting Rate of Return, Net Present Value, Internal Rate of Return and Profitability Index), Case Study (5 hours)

Short Term Investment Decisions

Working Capital: Nature, Type and Factors Affecting the Requirement of Working Capital, Case Study (5 hours)

Financing Decisions

Capital Structure: Essentials and Approaches of Capital Structure

Sources of Finance (long-term and short-term), Financial Leverage: Concept and Numerical Application, Case Study (6 hours)

Dividend Decisions

Types of Dividend, Dividend Policy: Nature and Factors Affecting Dividend Policy, Case Study (6 hours)

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Financial Management	Shah P.	2nd Edition, Pubs: Dreamtech Press.
2	Financial Markets and Services	Gordon E. and Natarajan K	3rd Edition, Pubs: Himalaya Publishing House.
3	Financial Management: Theory and Practice	Chandra P	8th Edition, Pubs
4	Financial Management	Pandey I.M	10th Edition, Pubs: Vikas Publishing House Pvt. Ltd., Noida.
5	Cases in Financial Management	Pandey I.M. and Bhat R	3rd Edition, Pubs: McGraw Hill Education (India).
6	Financial Institutions and Markets	Bhole L.M. and Mahakud J	5th Edition, Pubs: McGraw Hill Education (India).
7	The Indian Financial System	Pathak B.V.	3rd Edition, Pubs: Pearson India
8	Financial Management and Policy	Horne J.C.V. and Dhamija S	12th Edition, Pubs: Pearson India.

Course Code	**EE-810(iii)**
Course Title	**Marketing Management**
L T P	**3 1 0**
Type of Course	**Elective III**
Credits	**3**
Course Assessment Methods End semester assessment (university exam) Continuous Assessment (Sessional,Assessments,Quiz)	 **50** **50**
Course Pre-requisites	-
Course objectives	The main aim of this course is to make students understand about the marketing concepts to be applied in real life and the marketing process for delivering value to customers.
Course Outcome (s)	The students will learn how to market goods and services effectively to different segments so as to deliver value to customers. The students will be able to formulate marketing mix and marketing strategies for different products and different sets of customers
SYLLABUS	
Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.	

SECTION- A

Introduction to Marketing

Concepts, Role, Scope and Types of Marketing, Case Study on Marketing Management (5 hours)

Marketing Research

Scope and Process of Marketing Research, Hypothetical Marketing Research Analysis (5 hours)

Consumer and Business Markets

Types of Markets, Building Customer ValueConsumer and Business Buying Behaviour: Factors Influencing Behaviour and Buying Decision Process

(6 hours)

Selection of Markets

Segmentation: Factors and Bases, Targeting and Positioning

Preparation of STP of Selected Product (6 hours)

SECTION- B

Marketing Mix

7 P's of Marketing Mix: Product, Price, Physical Distribution, Promotion, People, Process and Physical Evidence Formulation of Marketing Mix of Selected Product (4 hours)

Product Decisions

Product (Good or Service) Characteristics, Product Life-Cycle, Packaging and Branding, Product Development and Management (4 hours)

Pricing Decisions

Pricing Policies and Strategies, Factors Influencing Pricing (5 hours)

Physical Distribution Decisions

Marketing Channels, Channel Players, Physical Distribution, Managing Distribution,Analysis of Supply Chain Management – Case Studies (5 hours)

Promotion Decisions

Nature of Promotion Decisions, Managing Mass Communication and Personal Communication Analysis of Promotional Strategies – Case Studies (5 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Marketing Management: Concepts, Cases, Challenges and Trends	Govindarajan M	2nd Edition, Pubs: PHI Learning
2	Marketing Management", Kotler P., Keller K.L., Koshy A. and Jha M.,	Koshy A. and Jha M	., 14th Edition, Pubs: Pearson India.
3	Marketing Management	", Dibb S., Simkin L., Pride W.M. and Ferrell O.C.,	O.C., Pubs: Cengage Learning
4	Marketing Concepts and Strategies	Kumar A. and Meenakshi N	Pubs: Vikas Publishing House Pvt. Ltd., Noida.
5	Marketing Management	Gandhi J.C.,	Pubs: McGraw Hill Education (India).
6	Marketing: Managerial Introduction	Saxena R	Pubs: McGraw Hill Education.
7	Marketing	Etzel M.J., Walker B.J., Stanton W.J.	Pubs: McGraw Hill Education (India)
8	Super Marketwala: Secrets to Winning Consumer India	Mall D.,	Pubs: Random House India

Course Code	**EE-810(iv)**
Course Title	**Cyber Laws & IPR (Theory)**
Type of Course	**Elective III**
L T P	**3 1 0**
Credits	**03**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional)	 **50** **50**
Course Prerequisites	Computer Networks
Course Objectives	1. To familiarize students with the dynamics of Cyber Law with a focus on new forms of cybercrime, 2. To establish a basic knowledge on the technical side of Cyber Law, 3. To give an update of recent Cyber Laws developments and case law make students conversant with the social and intellectual property issues emerging from 'Cyberspace; 4. Explore the legal and policy developments in various countries to regulate Cyberspace; 5. Develop the understanding of relationship between commerce and cyberspace; and give students in depth knowledge of Information Technology Act and legal frame work of Right to Privacy, Data Security and Data Protection.
Course Outcomes	The students should be able to: 1. Describe the need for cyber law 2. Get familiarize with the dynamics of Cyber Law with a focus on new forms of cyber crime. 3. Get established a basic knowledge on the technical side of Cyber Law 4. Have an update of recent Cyber Laws developments and case law 5. Get engaged with today's Cyber Laws reality and debates 6. Work on tools for further study of Cyber Law

Note: *The examiner shall set seven questions of 10 marks each. First question has to be compulsory, having parts covering the whole syllabus. Three questions have to be set from Part A and three questions from Part B of the syllabus. Candidate is required to attempt at least two questions from each part. All the course outcomes must be covered by the question paper.*

SECTION-A

Basics of Computer & Internet Technology Internet, ISP & domain name; Network Security; Encryption Techniques and Algorithms; Digital Signatures	**(08 hours)**
Introduction to Cyber World Introduction to Cyberspace and Cyber Law; Different Components of cyber Laws; Cyber Law and Netizens	**(04 hours)**
E-Commerce Introduction to E-Commerce; Different E-Commerce Models; E-Commerce Trends and Prospects; E-Commerce and Taxation; Legal Aspects of E-Commerce.	**(09 hours)**

SECTION-B

Intellectual Property Rights IPR, Copyright and Patents, International Treaties and Conventions, Business Software Patents, Domain Name Disputes and Resolution.	**(10 hours)**
IT Act, 2000 Reasons, Aims, Objectives and Applications, Regulators under IT Act, Role of Certifying Authority, Digital Signature Certificates, Duties of the Subscribers, Cyber Crimes-Offences and Contraventions, Grey Areas of IT Act.	**(09 hours)**
Project Work Candidates will be required to work on a project. At the end of the course, students will make a presentation and submit the project report.	**(04 hours)**

RECOMMENDED BOOKS

S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	A Guide to Cyber Laws & IT Act 2000 with Rules & Notification	NandanKamath	Universal Law Publishing
2	Cyber Cops, Cyber Criminals & Internet	Keith Merill&Deepti Chopra	I K International
3	Information Technology Law	Diane Row Land, Routledge-Cavendish	
4	Handbook of Cyber Laws	Vakul Sharma	McMillian