ACADEMIC REGULATIONS
AND
COURSE STRUCTURE
(R19 Regulations)

ELECTRICAL
&
ELECTRONICS
ENGINEERING

FOR

B.Tech., FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2019-20)

VVIT
VASIREDDY VENKATADRI
INSTITUTE OF TECHNOLOGY

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

NAMBUR, PEDA KAKANI MANDAL, GUNTUR-522508
An Autonomous Institution, Approved by AICTE,
All Courses Accredited by NBA & NAAC with 'A' Grade, Permanently Affiliated to JNTUK University

ACADEMIC REGULATIONS (R19) FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2019-20 onwards

The B.Tech Degree of Jawaharlal Nehru Technological University Kakinada, Kakinada shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

VISION

To impart quality education through exploration and experimentation and generate socially-conscious engineers, embedding ethics and values, for the advancement in science and technology.

MISSION

- To educate students with a practical approach to dovetail them to industry-needs.
- To govern the institution with a proactive and professional management with passionate teaching faculty.
- To provide holistic and integrated education and achieve over all development of students by imparting scientific and technical, social and cognitive, managerial and organizational skills.
- To compete with the best and be the most preferred institution of the studious and the scholarly.
- To forge strong relationships and linkage with the industry.

OBJECTIVES

- Equip the institute with state-of-the-art infrastructure comparable to the best in the industry.
- Tap the resources of the best minds in the field as faculty and visiting faculty.
- Groom students to become global entrepreneurs and responsible citizens.
- Provide financial assistance to meritorious students.
- Requisition the services of the best HR managers to place our students in reputed industries.
- Provide conducive atmosphere to the faculty for Research & Development and ensure active participation of the students.

Department Vision

To nurture young and fresh minds into disciplined and globally competent technocrats with ethical values to excel in the arena of Electrical and Electronics Engineering leading to sustainable development of society.

Department Mission

- To produce qualified engineers with technical knowledge and innovative skills to cater the dynamic requirements in the field of Electrical and Electronics Engineering.
- To provide state-of-the-art resources that contributes to achieve excellence in teaching-learning, research and development activities.
- To produce graduates with leadership and Entrepreneurship qualities.
- To make our students life-long learners capable of building their careers upon a solid foundation of knowledge.
- Ensure that our students are well trained in interpersonal skills, team work, professional ethics, environmental awareness and participate in professional society activities.

1. Admission Criteria

The eligibility criteria for admission into UG Engineering programmes are as per the norms approved by Government of Andhra Pradesh from time to time.

The sanctioned seats in each programme in the college are classified into CATEGORY-A, and CATEGORY-B at 1st year level and only CATEGORY-A at Lateral Entry 2nd year level. The percentages of Category–A, Category-B and Lateral Entry Seats are decided from time to time by the Government of Andhra Pradesh.

- CATEGORY – A (70%): These seats are filled through Convener, EAMCET as per the norms approved by the Government of Andhra Pradesh.
- CATEGORY – B (30%): These seats are filled by the College as per the norms approved by the Government of Andhra Pradesh.
- Lateral Entry: Lateral entry candidates shall be admitted into the Third semester directly as per the norms approved by the Convener, ECET, and Government of Andhra Pradesh.

2. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

- A student after securing admission shall complete the B.Techprogramme in a minimum of four academic years (8 Semesters), and a maximum period of eight academic years starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech Course. Each student shall secure 160 credits (with CGPA>=4) required for the completion of the under graduate programme and award of B.Tech Degree.

3. Courses of Study

The following courses of study are offered at present as specializations for the B. Tech. Courses

S. No	Branch	Branch Code	Intake
1	Civil Engineering	01	120
2	Electrical and Electronics Engineering	02	180
3	Mechanical Engineering	03	180
4	Electronics and Communication Engineering	04	180
5	Computer Science and Engineering	05	240
6	Information Technology	12	180

4. Distribution and Weightage of Marks

i) The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory subject and 75 marks for practical subject. The Mini project work shall be evaluated for 50 marks and the Major Project work shall be evaluated for 150 Marks.

ii) For theory subjects the distribution shall be 40 marks for Internal Evaluation and 60 marks for the Semester End Examinations.

iii) For theory subjects, during the semester there shall be two internal Mid Examinations. The weightage of internal marks for 40 consists of Descriptive Test – 15 Marks, Assignment Test- 10 Marks (Open book system with questions in accordance with BLOOMS taxonomy), and Objective Test -10 Marks and Subject Seminar 5 marks.

- The Descriptive Test is for 90 minutes duration conducted for 30 marks and will be scaled down to 15 Marks. Each Descriptive test question paper shall contain 3 questions, one question from each unit and all questions need to be answered. All the questions should be prepared in accordance with BLOOMS Taxonomy.
- The Assignment Test conducted for 20 Marks and will be scaled down to 10 Marks. The test is open book system and the duration of the exam is 60 minutes. The assignment question paper contains 3 questions given by the subject teacher concerned and all questions should be answered. Students can bring a maximum of three printed text books related to that subject. (Soft copies of the text books will not be allowed.) The assignments have to provide broadened exposure to the course. The questions shall include problem solving approach, problem analysis & design, implementation, case studies etc.
- The objective examination is for 20 minutes duration. (Conducted with 20 multiple choice question with a weightage of ½ Mark each)
- For the subject seminar, marks of each student shall be evaluated based on the presentation on any topic of his/her choice in the subject duly approved by the faculty member concerned.
- Internal Marks shall be calculated with 70% weightage for better of the two Mid Exams and 30% weightage for other.

iv) The Semester end examination shall be conducted for 3 hours duration. The question paper shall be given in the following pattern:
The question paper contains one question from each unit with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus. The questions shall be framed in line with the Course Outcomes defined and cognitive levels.

v) For practical subjects there shall be continuous internal evaluation during the semester for 25 marks and 50 Marks for Semester end examination. The internal 25 marks shall be awarded as follows: day to day work - 05 marks, Record-05 marks and the remaining 15 marks are to be awarded by conducting an internal laboratory test of 3 hours duration.
The semester end examination for laboratory courses shall be conducted for three hour duration at the end of semester for 50 marks as follows: Procedure - 10 marks, Experiment/Program execution – 15 Marks, Results-10 Marks and Viva-voice -15 Marks. For laboratory course in English 30 marks for written exam which includes listening comprehension and 20 marks for viva which includes JAM and Group Discussion.

vi) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 40 marks for internal evaluation (20 marks for day –to– day work, and 20 marks for internal tests) and 60 marks for end examination. There shall be two internal tests in a Semester and the Marks for 20 can be calculated with 70% weightage for better of the two performances and 30% weightage for other and these are to be added to the marks obtained in day-to-day work.

vii) For Engineering Project on Community services / Mini Project, there shall be continuous evaluation during the semester for 20 marks and semester end evaluation for 30 marks. The distribution of continuous evaluation marks is as follows: Day to Day Assessment- 05 Marks and average of two reviews of 15 Marks each.
The distribution of semester end examination marks for Engineering Project on Community services/Mini Project is as follows: Report -10 Marks and Presentation and Viva Voce – 20 Marks.

vii) For Major Project, there shall be continuous evaluation during the semester for 50 marks and semester end evaluation for 100 marks

The distribution of continuous evaluation marks is as follows: Day-to-day Assessment- 30 Marks and average of at least two reviews of 20 Marks each. The Departmental review committee consists of HoD, two senior Faculty and supervisor concerned.

The semester end examination for Major Project work shall be conducted at the end of VIII Semester. It is evaluated by the Committee consisting of an external examiner, Head of the Department, Senior Faculty and Supervisor of the Project.

viii) Laboratory marks and the internal marks awarded by the faculty are final. However, any grievance regarding marks will be addressed by the result committee if necessary. The recommendations of the committee are final and binding.

ix) MOOCS Courses: All students are eligible to register and complete MOOCS courses relevant to their professional electives listed by the respective departments in the curriculum.

However, if any student fails to complete a MOOCS course or the course is not offered by the agency concerned, that student is eligible to attend the examination following the same syllabus and pattern of examination in the VIII semester.

The MOOCS grades awarded to the student by the agency are converted to the course grades based on the percentage of marks obtained. The duration for course registered under MOOCS should range between 8 to 12 Weeks.

x) A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Industrial Oriented Mini Project/Summer Internship/practical training, if the student secures not less than 40% of marks (i.e., 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he/she (i) does not submit a report on Industrial Oriented Mini Project/Summer Internship, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required, or (iii) secures less than 40% of marks in Industrial Oriented Mini Project/Summer Internship and project seminar evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

5. Attendance Requirements

- Students shall put in a minimum average attendance of 75% in the semester.
- Condonation of shortage in attendance may be recommended by the respective Head of the Department on genuine medical grounds, provided the student puts in at least 65% attendance and the Principal is satisfied with the genuineness of the reasons and the conduct of the student.
- Students, having more than 65% and less than 75% of attendance, shall have to pay requisite fee towards condonation.
- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester. They may rejoin in that semester in which the student is detained by getting approval from the principal.
- If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible to readmit into the same class.

6. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No.5

- A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/project and secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the internal marks and end semester examination marks.
- A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement.
- A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of the credits up to II B.Tech II semester from all the examinations, whether or not the candidate takes the examinations and secure prescribed minimum attendance in II Year II Semester.
- A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III year II semester from all the examinations, whether or not the candidate takes the examinations and secure prescribed minimum attendance in III Year II Semester.
- A student shall register and put up minimum attendance in all 160 credits and earn all 160 credits.
- Break in Study: Student, who discontinues the studies for whatever may be the reason, can get readmission into appropriate semester of B. Tech programme after break in study, with the prior permission of the Principal and following the transitory regulations applicable to each batch in which he/she joins. A student may utilize this break in study (Maximum of Two years for Regular Students and Maximum of One Year for Lateral Entry Students) only once in the entire period of B. Tech program.

7. Course Pattern

- The entire course of study is for four academic years, all the years are on semester pattern and the medium of instruction is English.
- A student who eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.
- When a student is detained for lack of credits/shortage of attendance, he may be readmitted into the same semester in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

8. CGPA

The grade points and letter grade will be awarded to each course based on students' performance as per the grading system shown in the following Table.

Range of Marks (Theory)	Range of Marks (Lab)	Letter Grade	Level	Grade Points
≥ 90	≥ 67	**O**	Outstanding	10
≥80 to <90	≥60 to <67	**S**	Excellent	9
≥70 to <80	≥52 to <60	**A**	Very Good	8
≥60 to <70	≥45 to <52	**B**	Good	7
≥50 to <60	≥37 to <45	**C**	Fair	6
≥40 to <50	≥30 to <37	**D**	Satisfactory	5
<40	<30	**F**	Fail	0

ABSENT	ABSENT	**AB**	Absent	0

- **Computation of Semester Grade Point Average (SGPA)**

  The performance of each student at the end of each semester is indicated in terms of Semester Grade Point Average (SGPA)calculated as shown in below equation (1).

  $$\textbf{SGPA (Si)} = \sum \textbf{(Ci X Gi)} / \sum \textbf{Ci} \quad \text{---------- (1)}$$

  Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

- **Computation of Cumulative Grade Point Average (CGPA)**

  The Cumulative Performance of each student at the end of each semester is indicated in terms of CGPA and it is calculated as shown in equation (2).

  $$\textbf{CGPA} = \sum (\mathbf{C_i\ X\ S_i}) / \sum \mathbf{C_i} \quad \text{---------- (2)}$$

  Where Si is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- The approximate equivalence of marks to a given CGPA is calculated by using the formula:

  Percentage Equivalence of CGPA = [CGPA – 0.5] x 10

9. Award of Class

The criterion for the award of division, after successful completion of the program isas shown in the following table.

Class Awarded	CGPA to be secured	
First Class with distinction*	≥7.75	**From the CGPA secured from 160 credits**
First Class	≥6.5 - <7.75	
Second Class	≥5.5 - <6.5	
Pass Class	≥4 - <5.5	
Fail	<4	

* Awarded only if all the credit courses prescribed are cleared within four years for regular candidates and three years for lateral entry candidates

* The students who are approved for break in study for entrepreneurships/start-ups will also be considered for award of first class with distinction

* For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the program shall be considered.

10. Minimum Days of Instructions

Each semester consists of a minimum of 90 instruction days excluding examination days.

11. Transfer of Branch

There shall be no branch transfer after the completion of the first year admission process.

12. Withholding of results

If the student has not paid any dues to the college or if any case of indiscipline is pending against him/her, the result of the student will be withheld. His/her degree will be withheld in such cases.

13. Transitory Regulations

A candidate who is detained or discontinued a semester, on re-admission, he shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently. Also the academic regulations be applicable to him/her

which are in force at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional courses are to be studied as approved by the Board of Studies and ratified by the Academic Council.

14. Amendments to Regulations

Revisions of Regulations, Curriculum and Syllabi

The college may from time-to-time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Board of Studies with the approval of Academic Council and Governing Body of the college.

15. Transferred Students

The students seeking transfer to VVIT from various Universities/ Institutions have to obtain the credits of any equivalent subjects as prescribed by the Academic Council. Only the internal marks obtained in the previous institution will be considered for the evaluation of failed subjects.

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ACADEMIC REGULATIONS (R19) FOR B. Tech. (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2020-21 onwards

1. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

- A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years.
- The candidate shall register for 121 credits and secure all the 121 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech Lateral Entry Students.

3. Promotion Rule

- A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.
- A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4.Award of Class

After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	
First Class with distinction	≥7.75	**From the CGPA secured from 121 credits from II Year to IV Year**
First Class	≥6.5 - <7.75	
Second Class	≥5.5 - <6.5	
Pass Class	≥4 - <5.5	
Fail	<4	

5. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech Lateral Entry Scheme.

MALPRACTICE RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No.	Nature of Malpractices/Improper conduct	Punishment
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two

		consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations

		of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Controller o Examinations for further action to award suitable punishment.	

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In case any emergency call Toll Free No. 1800 425 1288
LET US MAKE VVIT A RAGGING FREE CAMPUS

Ragging

ABSOLUTELY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

In case any emergency call Toll Free No. 1800 425 1288

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COURSE STRUCTURE (R19)

I Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	HS01	Communicative English (Common to ALL)	3	1	0	3
2	BS01	Mathematics – I (Common to ALL)	3	1	0	3
3	BS02	Applied Physics	3	1	0	3
4	ES01	Programming for Problem Solving using C (Common to ALL)	3	1	0	3
5	ES02	Engineering Graphics	1	0	0	2.5
6	HS01L	Communicative English Lab-I (Common to ALL)	0	0	0	1.5
7	BS02L	Applied Physics Lab	0	0	0	1.5
8	ES01L	Programming for Problem Solving Using C Lab (Common to ALL)	0	0	0	1.5
9	MC01	Constitution of India	3	0	0	0
Total Credits						**19**

I Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BS03	Mathematics - II (Common to ALL)	2	1	0	3
2	BS04	Mathematics - III (Common to ALL)	2	1	0	3
3	BS05	Applied Chemistry	3	0	0	3
4	ES03	Data Structures	3	0	0	3
5	ES04	Basic Circuit Analysis	2	1	0	3
6	HS02L	Communicative English Lab - II (Common to ALL)	0	0	3	1.5
7	BS05L	Applied Chemistry Lab	0	0	3	1.5
8	ES03L	Data Structures Lab	0	0	3	1.5
9	ES05	Engineering Workshop	**0**	**0**	**3**	**1.5**
10	MC02	Environmental Studies	3	0	0	0
Total Credits						21

II Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BS06	Complex Variables and Statistical Methods	2	1	0	3
2	ES06	Python Programming	2	0	0	2
3	ES07	Basic Electronic Devices and Circuits	3	1	0	3
4	PC01	Electrical machines -I	3	1	0	3
5	PC02	Electrical Circuit Analysis	2	1	0	3
6	PC03	Electromagnetic Fields	2	1	0	3
7	ES06L	Python Programming Lab	0	0	2	1
8	ES07L	Basic Electronic Devices and Circuits Lab	0	0	3	1.5
9	PC02L	Electrical Circuit Analysis Lab	0	0	3	1.5
10	MC03	Essence of Indian Traditional Knowledge	2	0	0	0
Total Credits						**21**

II Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	ES09	Thermal and Hydro Prime Movers	2	1	0	2
2	PC04	Linear IC Applications	2	1	0	2
3	PC05	Electrical Machines - II	2	1	0	3
4	PC06	Control Systems	2	1	0	3
5	PC07	Power systems-I	3	1	0	3
6	PC08	Digital Electronics	2	1	0	3
7	ES09L	Thermal and Hydro Prime Movers Lab	0	0	2	1
8	PC05L	Electrical Machines - I Lab	0	0	3	1.5
9	PC06L	Control Systems Lab	0	0	3	1.5
10	PR01	Social Relevant Project	0	0	2	1
Total Credits						**21**

III Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	PC09	Power Systems - II	2	1	0	3
2	PC10	Special Electrical Machines	3	0	0	3
3	PC011	Power Electronics	3	0	0	3
4	OE01	Open Elective I	2	0	0	2
5	OE02	Open Elective II	3	0	0	3
6	PE01	Professional Elective I 1. Utilization of Electrical Energy 2. Signals and Systems 3. Energy Conservation & Auditing 4. High Voltage Engineering	3	0	0	3
7	PC05L	Electrical Machines –II Lab	0	0	3	1.5
8	PC011L	Power Electronics Lab	0	0	3	1.5
9	OE01L	IoT Lab	0	0	2	1
Total Credits						**21**

III Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	HS03	Managerial Economics & Financial Analysis	3	0	0	3
2	PC012	Microprocessors & Microcontrollers	2	0	0	2
3	PC013	Electrical Measurements and Instrumentation	3	0	0	3
4	PC014	Power System-III	2	1	0	3
5	OE03	Open Elective III	2	0	0	2
6	PE02	Professional Elective II 1. HVAC & DC Transmission 2. Advanced Control Systems 3. Electrical Machine Design 4. Renewable Energy Sources	3	0	0	3
7	PC012L	Microprocessors & Microcontrollers Lab	0	0	3	1.5
8	PC013L	Electrical Measurements and Instrumentation Lab	0	0	3	1.5
9	PR02	Mini Project	0	0	4	2
Total Credits						**21**

IV Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	HS04	Management Science	3	0	0	3
2	PC015	Switch Gear and Protection	3	0	0	3
3	PC016	FACTS	3	0	0	3
4	OE04	Open Elective IV	3	0	0	3
5	PE03	Professional Elective III 1. Electric Drives 2. PLC (Programmable Logic controller) 3. Power System Reliability 4. Reactive Power Compensation & Management	3	0	0	3
6	PC015L	Power systems Lab	0	0	3	1.5
7	OE04L	Big Data Analytics lab	0	0	3	1.5
8	PR03	Project stage- I	0	0	6	3
Total Credits						**21**

IV Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	PE04	Professional Elective IV 1. Digital Control Systems 2. Advanced Linear Continuous Control Systems 3. Electric Power Quality 4. SCADA Systems and Applications	3	0	0	3
2	PE05	Professional Elective V 1. Electric Vehicles 2. Advanced in UHV Transmission and Distribution 3. Introduction to smart Grid 4. NPTEL/ MOOC Course	3	0	0	3
3	OE05	Open Elective V 1. Digital Signal Processing 2. Sensors and Actuators 3. Introduction to coding theory 4. NPTEL/MOOC Course	3	0	0	3
4	PR04	Project stage -II	**0**	0	12	6
Total Credits						**15**

OPEN ELECTIVES

Open Elective-I	Open Elective-II	Open Elective-III	Open Elective-IV
1. Internet of Things	1. Neural Networks & Fuzzy Logic	1. Machine Learning	1. Cyber Security
2.Electrical Machines Modelling and Analysis	2.Advanced Python Programming	2. Big Data Analytics	2. Deep Learning
3.MEMS	3.BlockChain Technology	3. Nano-Technology	3. Object-Oriented Software Engineering
4.Cyber Security	4. Digital Systems Design with VHDL	4. Digital Signal Processing	4.E-Wast Management

List of Open Elective Subjects offered by EEE Branch

Open Elective-I

1.Neural Networks
2.Electrical Estimating and Costing
3.Principles of Electric Power Conversion

Open Elective-II

1.Programmable Logic Controller and Applications
2.Energy Storage Systems
3.Soft Computing Techniques

Open Elective-III

1.Electric Vehicles
2.Indian Electricity Act, 2003
3.Power Systems for Data Centres

Courses for Honors degree

POOL-1 (II-II)	POOL-2 (III-I)	POOL-3 (III-II)	POOL-4 (IV-I)
Analysis of Linear Systems	Energy Economics	Power System Optimization	Advanced Power Converters
Energy Storage Systems	Distribution System Engineering	Power System Protection	Hybrid Electrical Vehicle
Semiconductor Device Modeling	Sensors and Transducers	Advanced Power Systems	Modern Control Theory
Renewable Energy Sources	Process Control Engineering	Real Time Control of Power System	Power System Operation and Deregulation(PSOD)
MOOC-1*(NPTEL/SWAYAM) Duration:12Weeks minimum			
MOOC-2*(NPTEL/SWAYAM) Duration:12Weeks minimum			

*Course/subject title can't be repeated

General Minor Tracks

Department of Electrical and Electronics Engineering

S.No.	Course Name	L	T	P	C
1	Special Electrical Machines	3	0	2	4
2	Electrical Measurements and Instrumentation	3	0	2	4
3	M ATLAB for Engineering Applications	3	0	2	4
4	Generation of Electric Power	3	0	2	4
5	Energy audit	3	0	2	4
6	Non-conventional energy sources	3	0	2	4

Note:

i. A student can select four subjects from the above six subjects @3-0-2-4 credits per subject.

ii. Compulsory MOOC / NPTELcourses for 04 credits (02 courses @02 credits each)

I Year – I Semester

L	T	P	C
3	0	0	3

COMMUNICATIVE ENGLISH
(Common to All Branches)

Course Objectives

1. Adopt activity based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions.
2. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
3. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
4. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
5. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
6. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes

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

CO1. identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (L3)
CO2. formulate sentences using proper grammatical structures and correct word forms (L3)
CO3. speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)
CO4. write summaries based on global comprehension of reading/listening texts (L3)
CO5. produce a coherent paragraph interpreting a figure/graph/chart/table (L4)
CO6. take notes while listening to a talk/lecture to answer questions (L3)

Unit-1

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Unit-2

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Unit-3

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Unit-4

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.

Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Unit-5

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides.

Reading: Reading for comprehension.

Writing: Writing structured essays on specific topics using suitable claims and evidences

Grammar and Vocabulary: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Detailed Syllabus

Unit 1 A Proposal to Girdle the Earth (Excerpt) by Nellie Bly

Theme: Exploration

1. "How to Fashion Your Own Brand of Success" by Howard Whitman

2. "How to Recognize Your Failure Symptoms" by Dorothea Brande

Unit 2 An excerpt from The District School As It Was by One Who Went to It by Warren Burton

Theme: On Campus

3. **"How to Conquer the Ten Most Common Causes of Failure" by Lois Binstock**

4. **“How to Develop Your Strength to Seize Opportunities” by Maxwell Maltz**

Unit 3 The Future of Work?
Theme: Working Together

5. **“How to Make the Most of Your Abilities” by Kenneth Hildebrand**
6. **“How to Raise Your Self-Esteem and Develop Self-Confidence” by James W. Newman**

Unit 4 H.G Wells and the Uncertainties of Progress by Peter J. Bowler
Theme: Fabric of Change

7. **“How to Win Your War Against Negative Feelings” by Dr Maxwell Maltz**
8. **“How to Find the Courage to Take Risks” by Drs Tom Rust and Randy Reed**

Unit 5 Leaves from the Mental Portfolio of a Eurasian by Sui Sin Far
Theme: Tools for Life
9.“How to Become a Self-Motivator” by Charles T Jones
10. “How to Eliminate Your Bad Habits” by Og Mandino

*****

I Year – I Semester

L	T	P	C
3	0	0	3

MATHEMATICS – I
(Common to ALL branches)

Course Objectives:

1. This course will illuminate the students in the concepts of calculus.
2. To enlighten the learners in the concept of differential equations and multivariable calculus.
3. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Unit-1: Differential equations of first order and first degree:

Linear differential equations-Bernoulli's equations - Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

Unit-2: Linear differential equations of higher order:

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x^n , $e^{ax}V(x)$ and $x^nV(x)$ - Method of Variation of Parameters.

Applications: LCR circuit – Simple harmonic motion

Unit-3: Mean value theorems:

Mean value theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

Unit-4: Partial differentiation:

Introduction – Homogeneous function – Euler's theorem - Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.

Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

Unit-5: Multiple integrals:

Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar) –Triple integrals.

Applications: Areas by double integrals and Volumes by triple integrals.

TEXT BOOKS:

1. **B.S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

REFERENCE BOOKS:

1. **H. K. Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
2. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

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

- solve the differential equations related to various engineering fields.
- utilize mean value theorems to real life problems.
- familiarize with functions of several variables which is useful in optimization.

- apply double integration techniques in evaluating areas bounded by region.
- learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3 – dimensional coordinate systems.

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I Year – I Semester

L	T	P	C
3	0	0	3

APPLIED PHYSICS
(Common to ECE and EEE)

Course Objectives:

Applied Physics curriculum which is re-oriented to the needs of Circuital branches of graduate engineering courses offered by Vasireddy Venkatadri Institute of Technology, which serves as a transit to understand the branch specific advanced topics. The course is designed to:

- Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
- Understand the physics of Semiconductors and their working mechanism for their utility in electronic devices.
- Impart the knowledge of materials with characteristic utility in appliances.

Unit-I: Wave Optics:

Interference: Principle of Superposition-Interference of light – Conditions for sustained Interference-Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry) **Diffraction:** Fraunhofer Diffraction:- Diffraction due to single slit (quantitative), double slit(qualitative), N –slits(qualitative) and circular aperture (qualitative) – Intensity distribution curves - Diffraction grating – Grating spectrum – missing order– resolving power – Rayleigh's criterion – Resolving powers of Microscope(qualitative), Telescope(qualitative) and grating (qualitative).

Unit– II: LASERs and Holography

LASERs: Interaction of radiation with matter – Spontaneous and Stimulated emission of radiation – population inversion – Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser – Applications.

Holography: Introduction – principle – differences between photography and holography – construction and reconstruction of hologram – applications of holograms

Unit-III: Magnetism and Dielectrics

Magnetism: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment - Bohr magneton-Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

Dielectrics: Introduction- Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field-Claussius –Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.

Unit– IV: Quantum Mechanics

Introduction– matter waves – de Broglie's hypothesis – Davisson-Germer experiment – G.P.Thomson experiment – Heisenberg's Uncertainty Principle–Schrödinger time independent and time dependent wave equations – physical significance of Schrödinger wave function – Particle in a potential box (determination of energy).

Unit– V: Semiconductor Physics

Origin of energy bands (qualitative) -Classification of solids based on energy bands–Intrinsic

semiconductors- density of charge carriers –Electrical conductivity-Fermi level – extrinsic semiconductors- P-type &N-type- Density of charge carriers- Dependence of Fermi energy on carrier concentration and temperature- Hall effect- Hall coefficient- Applications of Hall effect- Drift and Diffusion currents - Einstein's equation.

TEXT BOOKS:

1. "Engineering Physics" by B. K. Pandey, S. Chaturvedi - Cengage Publications, 2012
2. "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G.Kshirsagar - S.Chand, 2017.
3. "Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).
4. "Engineering Physics" by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.

REFERENCE BOOKS:

1. "Engineering Physics" by M.R.Srinivasan, New Age international publishers (2009).
2. "Optics" by Ajoy Ghatak, 6th Edition McGraw Hill Education, 2017.
3. "Solid State Physics" by A.J.Dekker, Mc Millan Publishers (2011).

Course Outcomes:

The students will be able to

1. **Understand** the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments.
2. **Learn** the basic concepts of LASER light Sources and Apply them to holography
3. **Study** the magnetic and dielectric materials to enhance the utility aspects of materials.
4. **Learn** the fundamental concepts of Quantum behaviour of matter.
5. **Identify** the type of semiconductors using Hall Effect.

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I Year – I Semester

L	T	P	C
3	0	0	3

Programming for Problem Solving using C

(Common to All Branches)

Course Objectives:

1. To familiarize to notion of an algorithm, editing and executing programs in Linux.
2. To Understanding branching, iteration.
3. To represent Data using arrays.
4. To use Modular programming and recursive solution formulation.
5. To familiarize pointers and dynamic memory allocation.
6. To handle data through files

UNIT-I: Introduction to C

Introduction to Computers: hardware, Memory hierarchy, Types of Computers, Types of Software – Operating Systems, Translators, Device drivers and packages. Algorithms and its characteristics, Program development steps. Structure of a C program, Features of C, The main () Function, Standard I/O functions.

Programming Style - Indentation, Comments, Identifiers, Data Types**,** Operators, Precedence and Associativity. Variables and Declarations, Format Modifiers, Escape Sequences, Types of Statements

Casting - Implicit Type Conversions, Explicit Type Conversions, Mathematical Library Functions

UNIT-II: Control Flow & Modules

Selection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples.

Repetition: Basic Loop Structures, Pre-test and Post-test Loops, Counter-Controlled and Condition-Controlled Loops, for, while and do while.

Branching: break & continue.

Modular Programming: Function and Parameter Declarations, Returning a Value, Types of parameters. Parameter – scalar data as argument.

Recursion: Definition, Base condition for recursion, Mathematical Recursion, Recursion versus Iteration.

UNIT-III Arrays & Strings

Arrays: Introduction to Arrays, Input and Output of Array Values, Array Initialization, Arrays as Function Arguments, Two-Dimensional Arrays, Larger Dimensional Arrays- Matrices, 1D & 2D arrays as arguments.

Strings: String Fundamentals, String Input and Output, String Processing, Library Functions, Strings as arguments.

Unit – IV Pointers & Structures

Pointers: Concept of a Pointer, Initialization of Pointer variables, Pointers as function arguments, Passing by address, Dangling memory, Pointer Arithmetic, Character pointers, Pointers to Pointers, Array of pointers & Pointer to array, Dynamic memory management functions, Command line Arguments.

Structures: Derived types, Structure's declaration, Initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, enum, bit-fields.

UNIT-V: Files

Storage classes – auto, static, extern, register. Pre-processor statements

Data Files: Declaring, Opening, and Closing File Streams, File handling functions, Reading from and Writing to Text Files, File copy, merge, Writing and reading records, Random File Access.

Text Books:

1. ANSI C Programming, E Balaguruswamy, Mc-GrawHill, 5th Edition
2. ANSI C Programming, Gary J. Bronson, Cengage Learning.
3. Programming in C, ReemaThareja, OXFORD Publications

Reference Books:

1. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
2. Let us C, YashwantKanetkar, BPB Publications
3. Mastering in C, KR Venu Gopal, TMH

Course Outcomes: After completing this course, Students will be able to-

CO 1: Understand algorithms and basic terminology of C

CO 2: Solve problems using control structures and modular approach

CO 3: Make use of 1D and 2D arrays along with strings for linear data handling

CO 4: Determine the use of pointers and structures

CO 5: Implement various operations on data files.

****

I Year – I Semester

L	T	P	C
1	0	3	2.5

ENGINEERING GRAPHICS

Course Objectives:

- Expose the students to use Drafting packages for generating Engineering curves and conventions followed in Preparation of engineering drawings.
- Make the students to understand the concepts of orthographic projections of Lines and Plane Surfaces.
- To understand the concepts of orthographic projections of Regular Solids.
- Develop the ability of understanding sectional views and Development of Solid Surfaces.
- Enable them to use computer aided drafting packages for Conversion of Isometric view to Orthographic Projection and vice versa.

UNIT-I: INTRODUCTION TO AUTOCAD:

Basic commands, Customization, ISO and ANSI standards for coordinate dimensioning, Annotations, layering, 2D drawings of various mechanical components, 2D drawings of various electrical and electronic circuits. Creation of engineering models- floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; (Experiments should be Planned According to respective Core Branch Applications)

UNIT-II: THEORY OF PROJECTION:

Principles of Orthographic Projections-Convention: Projections of Points, Projections of Lines inclined to both planes, Projections of planes inclined to one Plane & Projections of planes inclined to both Planes

UNIT III: PROJECTIONS OF REGULAR SOLIDS:

Projections of Solids –with the axis perpendicular to one of the principal planes, with the axis Inclined to one of the principal planes, Projections of Solids –with the axis Inclined to Both the principal planes

UNIT IV: DEVELOPMENT OF SURFACES & SECTIONAL ORTHOGRAPHIC VIEWS

Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and, Cone. Draw the sectional orthographic views of geometrical solids

UNIT V: ISOMETRIC PROJECTIONS

Conversion of isometric views to orthographic views, drawing of isometric views - simple Solids, Conversion of orthographic views to isometric views of simple Drawings

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Graphics with Autocad by Kulkarni D.M , PHI Publishers
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age
4. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers

3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. AutoCAD 2018 Training Guide (English, Paperback, Sagar Linkan) ISBN: 9789386551870, 938655187X RUPAPUBLICATIONS

Websites

1 .https://www.autodesk.com.au/campaigns/autocad-tutorials
2. https://nptel.ac.in/courses/112104172

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

CO1: Prepare engineering drawings as per BIS conventions Understand level, KL2}

CO2: Produce computer generated of orthographic projections of Lines and Plane surfaces using CAD software {Apply level, KL3}

CO3: Use the knowledge of orthographic projections of Solids to represent engineering information/concepts and present the same in the form of drawings {Apply level, KL3}

CO4: Use the knowledge of sectional views and Development of Solid Surfaces in Real time Applications {Apply level, KL3}

CO5: Develop isometric drawings of simple objects reading the orthographic projections of those objects {Analyze level, KL4}

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I Year – I Semester

L	T	P	C
0	0	3	1.5

COMMUNICATIVE ENGLISH LAB I
(Common to All branches)

Course Objectives

The main objective of the course is to adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions and appear confidently for competitive examinations for career development.

The specific objectives of the course are to

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes

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

CO1. identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)

CO2. take notes while listening to a talk/lecture; to answer questions in English; formulate sentences using proper grammatical structures and correct word forms; and use language effectively in competitive examinations (L3)

CO3. write summaries based on global comprehension of reading/listening texts; produce a coherent write-up interpreting a figure/graph/chart/table; and use English as a successful medium of communication. (L3)

Detailed Syllabus

CALL based activity. English course books selected for classroom teaching will be used for practice in the computer-based language labs. However, a brief introduction to the English Phonetics will be given to the students. Activities that encourage individual learning of the students based on the suggested texts and web resources will be used in the practical sessions.

Introduction to Sound System of English

Articulation - Airstream mechanism, Manners of Articulation, Places of Articulation, English phonetic symbols.

Accent - Syllabification, word stress and accent, stress rules and stress shift, exceptions to rules.

Intonation - Stress and accent in connected speech. Types and functions of Intonation in English.

Pair work, Role play, conversational practice and Individual speaking activities based on following essays from ***University of Success.***

1. "How to Fashion Your Own Brand of Success" by Howard Whitman

2. "How to Recognize Your Failure Symptoms" by Dorthea Brand

3. "How to Conquer the Ten Most Common Causes of Failure" by Lois Binstock

4. **"**How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz
5. "How to Make the Most of Your Abilities" by Kenneth Hildebrand
6. "How to Raise Your Self-Esteem and Develop Self-Confidence" by James W. Newman
7. "How to Win Your War Against Negative Feelings" by Dr Maxwell Maltz
8. "How to Find the Courage to Take Risks" by Tom Rust and Randy Reed
9. "How to Become a Self-Motivator" by Charles T Jones
10. "How to Eliminate Your Bad Habits" by OgMandino

Text Books

1. English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019 (to be released)
2. University of Success by OgMandino, Jaico, 2015.

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

AICTE Recommended Books

1. Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press, 2018.
2. Pushplata and Sanjay Kumar. Communication Skills, Oxford University Press, 2018.
3. Kulbushan Kumar. Effective Communication Skills. Khanna Publishing House, Delhi

Sample Web Resources

Grammar / Listening / Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/ http://www.nonstopenglish.com/ https://www.vocabulary.com/ BBC Vocabulary Games Free Rice Vocabulary Game	Reading: https://www.usingenglish.com/comprehension/ https://www.englishclub.com/reading/shortstories.htm https://www.english-online.at/Listening https://learningenglish.voanews.com/z/3613 http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/ BBC Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises
All Skills https://www.englishclub.com/ http://www.world-english.org/ http://learnenglish.britishcouncil.org/	

I Year – I Semester

L	T	P	C
0	0	3	1.5

APPLIED PHYSICS LAB

Course Objectives:

The Applied Physics Lab is designed to:

- Understand the concepts of interference and diffraction and their applications.
- Apply the concept of LASER in the determination of wavelength.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect.
- Illustrate the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

Course Outcomes:

The students will be able to:

1. Operate optical instruments like microscope and spectrometer
2. Determine thickness of a paper with the concept of interference
3. Estimate the wavelength of different colours using diffraction grating and resolving power
4. Plot the intensity of the magnetic field of circular coil carrying current with distance
5. Calculate the band gap of a given semiconductor

LIST OF EXPERIMENTS

(Any 10 of the following listed 15 experiments)

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
5. Energy Band gap of a Semiconductor p - n junction.
6. Characteristics of Thermistor – Temperature Coefficients
7. Determination of dielectric constant by charging and discharging method
8. Variation of dielectric constant with temperature
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10. LASER - Determination of wavelength by plane diffraction grating
11. Determination of resistivity of semiconductor by Four probe method.
12. Determine the radius of gyration using compound pendulum
13. Rigidity modulus of material by wire-dynamic method (torsional pendulum)
14. Dispersive power of diffraction grating.
15. Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall Effect.

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I Year – I Semester

L	T	P	C
0	0	3	1.5

Programming for Problem Solving Using C **LAB**

(Common to All Branches)

Course Objectives:

1. Apply the principles of C language in problem solving.
2. To design flowcharts, algorithms and knowing how to debug programs.
3. To design & develop of C programs using arrays, strings pointers & functions.
4. To review the file operations, pre-processor commands.

Exercise - 1 Control Flow - I

a) Write a C Program to Find Whether the Given Year is a Leap Year or not.

b) Write a C Program to find second biggest of three numbers (Assume that all the numbers are unique).

Exercise – 2 Control Flow - II

b) Write a C Program to Find Whether the Given Number is

i) Prime Number

ii) Armstrong Number

Exercise – 3 Control Flow - III

a) Write a C program to print Floyd Triangle

b) Write a C Program to print Pascal Triangle

c) Write a C program to display a Pyramid

Exercise – 4 Arrays - Demonstration of arrays

a) Search-Linear.

b) Sorting-Bubble

c) Operations on Matrix. - Add, Subtract, Multiply

Exercise – 5 Strings

a) Implementation of string manipulation operations **with** library function: Copy, length, compare

b) Implementation of string manipulation operations **without** library function: copy, length, compare

Exercise – 6 Functions

a) Write a C Program demonstrating of parameter passing in Functions and returning values.

b) Write a C Program illustrating Fibonacci, Factorial with Recursion without Recursion

Exercise – 7 Functions - Continued

Write a C Program to compute the values of sin x and cos x and ex values using Series expansion. (Use factorial function)

Exercise - 8 Arrays, Strings and Pointers

a) Write a C Program to find min and max of an array of elements using pointers

b) Write a C Program to concatenate one string to another using pointer.

Exercise – 9 Dynamic Memory Allocations

Write a C program to represent 1D and 2D arrays using malloc () function.

Exercises - 10 Structures

a) Write a C Program to Store Information of a Movie Using Structure

b) Write a C Program to sort a set of student records in ascending order.

c) Write a C Program to Add, subtract & multiply Two Complex Numbers.

Exercise -11 Files

a) Write a C programming code to open a file and to print it contents on screen.

b) Write a C program to copy the content of one file to another.

C) Write a C program merges two files and stores their contents in another file

Course Outcomes: By the end of the Lab, the student able to

1. **Comprehend** the various concepts of a C language
2. **Develop** algorithms and flowcharts
3. **Design** and development of C problem solving skills.
4. **Acquire** modular programming skills.

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I Year – I Semester

L	T	P	C
3	0	0	0

CONSTITUTION OF INDIA

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative.

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-IV

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Panchayati: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women

Course Outcomes: At the end of the semester/course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt.Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-RESOURCES:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

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I Year – II Semester

L	T	P	C
2	1	0	3

MATHEMATICS-II
(Common to All)

Course Objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications

UNIT-1: Iterative methods: (10 hrs)

Introduction–Bisection method–Method of false position–Iteration method–Newton-Raphson method (one variable)–Jacobi and Gauss-Seidel methods for solving system of equations.

UNIT-2: Interpolation: (12 hrs)

Introduction–Errors in polynomial interpolation–Finite differences–Forward differences–Backward differences–Central differences –Relations between operators–Newton's forward and backward formulae for interpolation–Gauss's forward and backward formulae for Interpolation – Interpolation with unequal intervals–Lagrange's interpolation formula–Newton's divide difference formula.

UNIT-3: Numerical integration and solution of ordinary difference equations: (10 hrs)

Trapezoidal rule–Simpson's $1/3^{rd}$ and $3/8^{th}$ rule–Solution of ordinary differential equations by Taylor's series–Picard's method of successive approximations–Euler's method–Modified Euler's method–Runge-Kutta method (second and fourth order).

UNIT–4: Laplace Transforms: (14 hrs)

Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function –Periodic function - Inverse Laplace transforms – Convolution theorem (without proof)

Applications: Evaluation of integrals using Laplace transforms - Solving ordinary differential equations (Initial value problems) using Laplace transforms.

UNIT 5: Fourier series and Fourier Transforms: (14 hrs)

Fourier series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) - Fourier sine and cosine integrals – Sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

Text Books:

1. **B.S. Grewal,** Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers.

Reference Books:

1. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
2. **H.K.Das,** Advanced Engineering Mathematics, 22^{nd} Edition, S. Chand & Company Ltd.
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10^{th} Edition, Wiley-India.

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

- Evaluate approximate in the roots of polynomial and transcendental equations by different algorithms (EVALUATE)
- Solve system of linear algebraic equations using Gauss Jacobi, Gauss Seidel and apply Newton's forward and backward interpolation and Lagrange's formulae for equal and unequal intervals (SOLVE , APPLY,FIND)
- Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations and also by Laplace the transforms for solving differential equations (SOLVE , APPLY,FIND)
- Find or compute the Fourier series of periodic signals (SOLVE ,APPLY, FIND, ANALYSE)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms (SOLVE , APPLY, FIND)

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I Year – II Semester

L	T	P	C
2	1	0	3

MATHEMATICS – III
(Common to ALL branches)

Course Objectives:

1. To instruct the concept of Matrices in solving linear algebraic equations
2. To familiarize the techniques in partial differential equations
3. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications

UNIT-I: Solving system of linear equations, Eigen values and Eigen Vectors (12 hrs)

Rank of a matrix by Echelon form and normal form–solving system of homogeneous and non-homogeneous linear equations–Gauss elimination, Gauss Jordan for solving system of equations- Eigen values and Eigen vectors and their properties

UNIT-II: Cayley-Hamilton theorem and quadratic forms: (12 hrs)

Cayley-Hamilton theorem (without proof)–Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form–Quadratic forms and nature of the quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.

Application: Free vibration of two mass systems.

UNIT – III: Vector Differentiation: (10 hrs)

Scalar and Vector point functions-Vector Differential operator- Gradient – Directional derivatives– Divergence – Curl – Laplacian second order operator- Vector identities- Scalar Potential.

UNIT– IV: Vector Integration: (12 hrs)

Line integral – Work done – Circulation- Surface integral- Volume integral Vector integral theorems (without proof): Greens theorem in a plane- Stokes theorem- Gauss Divergence theorem.

UNIT– V: Solutions of Partial differential Equations (14 hrs)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

Second order PDE: Solutions of linear partial differential equations with constant coefficients RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

Text Books:

2. **B.S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.

Reference Books:

4. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
5. **H.K.Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
6. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

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

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan (L3)

- to interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L5)
- identify the solution methods for partial differential equation that model physical processes (L3)

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I Year – II Semester

L	T	P	C
3	0	0	3

APPLIED CHEMISTRY

Knowledge of basic concepts of chemistry for Engineering students will help them as professional engineers later in design and material selection as well as utilizing the available resources.

Learning Objectives:

1. Significance of various types of plastic materials in household appliances and composites (FRP) in aerospace and automotive industries.
2. Understand the basic concepts of electrochemistry, which are useful to construct the electrochemical cells, batteries and fuel cells.
   Illustrate the theories and mechanism of corrosion and its prevention.
3. Importance of advanced materials and their engineering applications.
4. Make use of molecular machines in supramolecular chemistry and need of green chemistry.
5. Design and construction of advanced instrumental techniques and recall their importance.

UNIT-I: POLYMER TECHNOLOGY **14 HRS**

Polymerisation: Introduction-Methods of polymerisation-(emulsion and suspension)-Physical and mechanical properties.

Plastics: Compounding-Fabrication (compression, injection, blown film, extrusion)-Preparation, properties and applications of PVC, ploycarbonates and Bakelite-Mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

Elastomers: Natural rubber-Drawbacks-Vulcanization-Preparation-Properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes)

Composite Materials: Fiber reinforced plastics-CFRP and GFRP

Conducting polymers: Polyacetylene, doped conducting polymers -p-type and n-type doping.

Bio degradable polymers: Biopolymers and biomedical polymers.

UNIT-II: ELECTROCHEMICAL CELLS AND CORROSION **12 HRS**

Single electrode potential-Electrochemical series and uses of series-Standard hydrogen electrode, calomel electrode, concentration cell, construction of glass electrode, Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li-ion battery, Zinc air cells, Fuel cells-H_2 –O_2, CH_3OH-O_2, phosphoric acid, molten carbonate.

Corrosion: Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, water-line corrosion- passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control: (proper designing, cathodic protection)-protective coatings: cathodic and anodic coatings, electroplating, electroless plating (nickel), paints (constituents and its functions).

UNIT-III: MATERIAL CHEMISTRY **12 HRS**

Non-elemental semiconducting materails: Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling technique) – Semiconductor devices (p-n junction diode as rectifier, junction transistor)

Insulators, Ferro, Ferri Magnetic Materials, Hall Efect

Nano materials: Introduction, sol-gel method, characterization by BET, SEM and TEM methods, applications of graphene-carbon nanotubes and fullerenes: Types, preparation of carbon nanomaterials by carbon-arc, laser abalation methods.

Liquid crystals: Introduction-types-applications.

Superconductors: Meissner effect, type- I and type- II superconductors, characteristics and applications.

UNIT-IV: ADVANCED CONCEPTS AND GREEEN CHEMISTRY **10 HRS**

Molecular switches and machines: Introduction to supramolecular chemistry, characteristics of molecular motors and machines. Rotaxanes and Catenanes as artificial molecular machines. Protypes

linear motions in Rotaxanes, and acid-base controlled molecular shuttle, a molecular elevator, an autonomous light –powered molecular motors, natural molecular motors and machine.

Green chemistry: Principles of green chemistry, green synthesis – aqueous phase, microwave assisted chemical reactions and phase transfer catalysis (PTC).

UNIT-V: SPECTROSCOPIC TECHNIQUES & NON-CONVENTIONAL ENERGY SOURCES **12 HRS**

Spectroscopic Techniques: Electromagneticspectrum-types of molecular spectra and their absorption criteria.

UV-visible spectroscopy (electronic spectroscopy), Frank-Condon principle, Beer-Lambert's law and its limitations, chromophores and auxochromes – *applications of UV visible spectroscopy.

IR spectroscopy – functional group and finger print region – molecular vibrations – stretching and bending vibrations – *applications of IR.

NMR (Nuclear magnetic resonance): Working principle and instrumentation of NMR – chemical shift(δ) – *applications of NMR.

(*only general applications – without any spectroscopic problems regarding quantitative and qualitative analysis.)

Non-conventional energy sources: Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, organic photo-voltaic, hydropower, geothermal power, tidal, ocean thermal energy conversion (OTEC) – open cycle OTEC, closed cycle OTEC and hybrid cycle OTEC.

REFERENCE BOOKS:

1. A text book of Engineering Chemistry by S.S. Dara, S. S. Umare; S. Chand & Co., Ltd., Latest Edition.
2. Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publicating Co., Latest Edition.

TEXT BOOKS:

1. Engineering Chemistry by Jain & Jain; Dhanpat Rai Publicating Co., Latest Edition
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 Edition.
3. Engineering Chemistry by Prasanth Rath, B. Ramadevi, Ch. Venkata Ramana Reddy, Subendu Chakravarthy; Cengage Publications, 2019 Edition.

Course Outcomes:

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

1. explain the preparation, properties and applications of thermoplastics, thermosettings, elastomers and conducting polymers.
2. know the importance of various materials and their uses in the construction of batteries and fuel cells.
3. know the applications of advanced materials in various industries.
4. apply the principles of supramolecular chemistry in the applications of molecular machines, need of green chemistry.
5. explain the principles of spectrometry such as UV, IR, and NMR.

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I Year – II Semester

L	T	P	C
3	0	0	3

DATA STRUCTURES

Course Objectives:

1) To solve problems using data structures such as linear lists, stacks, queues.
2) To explore advanced data structures such as balanced search trees.
3) To be familiar with Graphs and their applications.
4) To analyze various sorting techniques.

UNIT-I: Arrays (12 hrs)

Introduction to data structures – Definition, types of data structures. Introduction to lists – operations: insert, delete, Searching- Linear Search, Binary Search. Sorting - Selection sort, Insertion Sort, Quick Sort, Merge Sort, and Heap Sort.

UNIT-II: Stack & Queue (10 hrs)

Introduction to Stack, Stack Applications- Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix, Decimal to binary conversion. Introduction to Queue and its operations – Enqueue, Dequeue. Circular queue operations, Applications.

Unit – III: Linked Lists (10 hrs)

Introduction to Single Linked List and its representation. Defining a Node in C – Implementation of operation: Insert, delete, search and sort. Circular Lists, Linked Stacks and Queues, Polynomials, Polynomial Representation- Adding Polynomials- Subtracting and multiplying two polynomials, Doubly Linked list – create, insert, delete, and view.

UNIT-IV: TREES (8 hrs)

Introduction, Terminology, Representation of Trees, Binary Trees, Properties of Binary Tress, Binary Tree Representations, Binary Tree Traversal, Introduction, Inorder Traversal Preorder Traversal, Postorder Traversal, Thread Binary Trees, Binary Search Trees, Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree.

UNIT-V: GRAPHS (12 hrs)

Introduction to Graphs, Definition, Graph Representation- adjacency matrix & adjacency list, Degree of vertex, Types of graphs, Elementary Graph Operation, Depth First Search, Breadth First Search, Spanning Trees - Minimum Cost Spanning Trees, Kruskal's Algorithm, Prims Algorithm and Warshall's algorithm.

TEXT BOOKS:

1. Data structures, Algorithms and Applications in C, S.Sahni, University Press (India) Pvt. Ltd, 2nd edition, Universities Press, Pvt. Ltd.
2. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd, Second Edition.
3. Data Structures, Schaum's Outline, Seymour Lipschutz, Kindle Edition.

REFERENCE BOOKS:

1. Introduction to Algorithms, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, MIT Press.
2. Classical Data Structures, Second Edition, Debasis Samanta, PHI

Course Outcomes: After completing this course, Students will be able to-

CO1: Implement various operations on linear lists.

CO2: Apply data structure strategies like stacks and queues for exploring complex data structures.

CO3: Analyze performance and trade-offs of static and dynamic data structures..

CO4: Incorporate data structures into the applications such as binary trees, binary search trees.
CO5: Identify appropriate data structure algorithms for graphs.

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I Year – II Semester

L	T	P	C
2	1	0	3

BASIC CIRCUIT ANALYSIS

Pre-Requisites: Integrations,
Laplace transforms and
Differential equations

Course objectives:

- To study the concepts of network elements and network reduction techniques.
- To understand the behavior of RLC networks for sinusoidal excitations.
- To study the performance of different circuits and to understand the concept of resonance.
- To understand the applications of network theorems.
- To study the concept of magnetic coupled circuits.

Unit-1 Introduction to Electrical Circuits

Passive components and their V-I relations. Sources (dependent and independent, Ideal and Practical) -Kirchhoff's laws, Network reduction techniques, source transformation techniques, Nodal analysis and Mesh analysis with DC excitation.

Unit-2 Single Phase A.C Systems

RMS, average value, form factor and Peak factor for Periodic waveforms, Concept of phase, phase angle and phase difference, 'j' operator, waveforms and phasor diagrams for lagging and leading networks. Concept of Impedance and admittance- steady state analysis of R, L and C circuits with sinusoidal excitation, real, reactive power, apparent power and power triangle.

Unit-3 Analysis of AC Networks

Nodal and Mesh analysis with AC excitation, resonance and anti-resonance, selectivity, band width and Quality factor, voltage and current magnification factor, locus diagrams.

Unit-4 Network theorems (DC & AC Excitations)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem and Telligen's theorem.

Unit-5 Magnetic Circuit

MMF, flux, reluctance, flux density, field intensity and its relations. Analogy between electrical and magnetic circuits. Faraday's laws of electromagnetic induction, Concept of self and mutual inductance, Dot convention, coefficient of coupling and composite magnetic circuit.

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

CO1 Various electrical networks in presence of active and passive elements. **{Apply level, KL3}**

CO2 Any R, L, C network with sinusoidal excitation.. **{Apply level, KL3&Analyse level, KL4}**

CO3 Any R, L, C network with variation of any one of the parameters i.e R, L, C. and f.**{Apply level, KL3& Analyse level, KL4}**

CO4 Electrical networks by using principles of network theorems.**{Apply level, KL3}**
CO5 Any magnetic circuit with various dot conventions. **{Apply level, KL3}**

Text Books:

1. "Fundamentals of Electric Circuits "Charles K.Alexander, Mathew N.O.Sadiku, Tata McGraw-Hill.
2. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,Mc Graw Hill Company,6th edition
3. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd.
4. 3000 Solved Problems in Electrical Circuit by Schaum's solved problem series Tata McGraw- Hill.

Reference Books:

1. Circuits & Networks Analysis & Synthesis by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill.
2. Network Analysis by N.C.Jagan, C.Lakshmi Narayana BS publications 2nd edition
3. Circuit Theory by A.Chakrabarti Danapat Rai & Co publisher.

e- Resources & other digital material:

1. https://www.youtube.com/watch?v=8gMuLr_0-TI&t=7s
2. https://www.youtube.com/watch?v=pO9qgzzRWaA&t=337s
3. https://www.youtube.com/watch?v=HcgDoL9YtMM&t=15s
4. https://www.youtube.com/watch?v=MdPLQFFeQ30&t=74s
5. https://www.youtube.com/watch?v=Q-qKhjXYFPQ

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I Year – II Semester

L	T	P	C
0	0	3	1.5

COMMUNICATIVE ENGLISH LAB - II

(Common to All Branches)

The main objective of the course is to adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions and appear confidently for competitive examinations for career development.

The specific objectives of the course are to

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes

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

CO1. prioritize information from reading texts after selecting relevant and useful points and paraphrase short academic texts using suitable strategies and conventions (L3)

CO2. make formal structured presentations on academic topics using PPT slides with relevant graphical elements (L3)

CO3. participate in group discussions using appropriate conventions and language strategies (L3)

CO4. prepare a CV with a cover letter to seek internship/ job (L2)

CO5. collaborate with a partner to make presentations and Project Reports (L2)

Detailed Syllabus

CALL based activity. English course books selected for classroom teaching will be used for practice in thecomputer-based language labs. Watching and listening to Video clips.

Listening Activity: Selected speeches of eminent personalities, audio texts, dialogues and discussions

Speaking: JAM, Oral Presentations, Group Discussions

Writing: Different types of reports

Project: Power point presentation of 5 min on a specific topic

Pair work, Role play, conversational practice and Individual speaking activities based on following essays from ***University of Success***.

1. "How to Get Yourself Organized" by Michael LeBeouf
2. "How to Turn Your Desires into Gold" by Napoleon Hill
3. "How to Look Like a Winner How to Increase Your Value" by OgMandino
4. "How to Swap a Losing Strategy" by Auren Uris and Jack Tarrant
5. "How to Bounce Back from Failure" by OgMandino
6. "How to Prevent Your Success from Turning into Ashes" by Allan Fromme

7. “How to Have a Happy Life” by Louis Binstock
8. “How to Keep the Flame of Success Shining Brightly” by Howard Whitman

Any ten Supplementary Language Activities from ***UN Global Goals***document

1. “Developing children’s understanding of the Global Goals” by Carol Read
2. “End poverty in all its forms everywhere” by SylwiaZabor-Zakowska
3. “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” by Linda Ruas.
4. ‘Ensure healthy lives and promote well-being for all at all ages” by Carmen Flores
5. “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” by Daniel Xerri
6. “Achieve gender equality and empower all women and girls” by Jemma Prior and Tessa Woodward
7. “Ensure availability and sustainable management of water and sanitation for all” by Wei KeongToo
8. “Ensure access to affordable, reliable, sustainable and modern energy for all” by Phil Wade
9. “Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all” by Nik Peachey
10. “Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation” by MaluSciamarelli
11. “Reduce inequality within and among countries” by Alan Maley
12. “Make cities and human settlements inclusive, safe, resilient and sustainable” by David Brennan
13. “Ensure sustainable consumption and production patterns” by Laszlo Katona and Nora Tartsay
14. “Take urgent action to combat climate change and its impacts” by Maria Theologidou
15. “Conserve and sustainably use the oceans, seas and marine resources for sustainable development” by Jill Hadfield and Charlie Hadfield
16. “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss” by ChrysaPapalazarou
17. “Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels” by RebecaDuriga.
18. “Strengthen the means of implementation and revitalise the global partnership for sustainable development” by Jennifer Verschoor and Anna Maria Menezes
19. “Content and the Sustainable Development Goals: going beyond language learning” by AdrianTennant
20. “Using extensive reading creatively to raise awareness of issues of equality and justice” by SueLeather
21. “Storytelling for a better world” by David Heathfield
22. “Using the Sustainable Development Goals in the EAP classroom” by Averil Bolster and PeterLevrai

Text Books

1. Alan Maley and Nik Peachy. *Integrating global issues in the creative English Classroom: Withreference to the United Nations Sustainable Development Goals.* British Council Teaching English, 2018 (Public Domain UN Document)

2. *University of Success* by OgMandino, Jaico, 2015 (Reprint).

Reference Books

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
5. Chaturvedi, P. D. and ChaturvediMukesh. *The Art and Science of Business Communication:Skills, Concepts, Cases and Applications.* 4Ed. Pearson, 2017.

AICTE Recommended Books

1. Meenakshi Raman and Sangeeta Sharma. *Technical Communication.* Oxford University Press,2018.
2. Pushplata and Sanjay Kumar. *Communication Skills*, Oxford University Press, 2018.
3. Kulbushan Kumar. *Effective Communication Skills.* Khanna Publishing House, Delhi

Sample Web Resources

Grammar / Listening / Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/ http://www.nonstopenglish.com/ https://www.vocabulary.com/ BBC Vocabulary Games Free Rice Vocabulary Game	Reading https://www.usingenglish.com/comprehension/ https://www.englishclub.com/reading/short stories.htm https://www.english-online.at/ Listening https://learningenglish.voanews.com/z/3613 http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/ BBC Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises
All Skills https://www.englishclub.com/ http://www.world-english.org/ http://l	

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I Year – II Semester

L	T	P	C
0	0	3	1.5

APPLIED CHEMISTRY LAB

Learning Objectives:

1. To furnish the students with a solid foundation in Chemistry Laboratory required to solve the Engineering problems.
2. To expose the students in practical aspects of the theoritical concepts like pH, hardness of water etc.
3. To guide the students on how to handle the instruments like UV-visible spectrophotometer, potentiometer and conductometer.

Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations quantitative analysis .

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of Copper (II) using standard EDTA solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of Iron (III) by colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metric method).
9. Determination of concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of Mg^{+2} present in an antacid.
12. Determination of $CaCO_3$ presence in an egg shell.
13. Estimation of vitamin- C.
14. Determination of phosphoric content in soft drinks.
15. Adsorption of acetic acid by charcoal.
16. Prepatation of nylon-6, 6 and Bakelite (demonstration only)

Note: Choice of any 10 experiments from the above.

Course Outcomes:

At the end of the course, the students will be able

- To estimate the amount of metal ions present in different solutions (L4 & L3)
- To analyze the quality parameters of water (L4)
- To determine the strength of different solutions by using different instrumentation techniques (L3)

Reference Books:

A Text Book of Quantitative Analysis, Arthur J. Vogel.

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I Year – II Semester

L	T	P	C
0	0	3	1.5

DATA STRUCTURES LAB

Course Objectives:

1. To develop skills to design and analyze simple linear and nonlinear data structures.
2. To Strengthen the ability to identify and apply the suitable data structure for the given real world problem.
3. To Gain knowledge in practical applications of data structures.

List of Experiments:

Excercise-1: Implementation of Data Searching (Linear & Binary Search).
Excercise-2: Write C code for implementing sorting techniques: Selection & Insertion.
Excercise-3: Develop C code to demonstrate Merge Sort technique in C.
Excercise-4: Implementation of Quick Sort technique in C.
Excercise-5: Implement Stack operations using arrays –
i) push ii) pop iii) is Stack empty iv) is Stack full, v) peep vi) list.
Excercise-6: Implement Queue operations using arrays –
i) enqueue, ii) dequeue, iii) list, iv) is Queue empty, v) is Queue full
Excercise-7: Create a Circular Queue and its operations using arrays –
i) enqueue, ii) dequeue, iii) list, iv) is Queue empty, v) is Queue full
Excercise-8: Implement singly linked list and its operations:
i) insert, ii) delete, iii) search, iv) count.
Excercise-9: Create a Circular linked list and display the content.
Excercise-10: Implement doubly linked list and its operations:
i) Create ii) List iii) search.
Excercise-11: Develop C code for converting an Infix expression to postfix notation.
Excercise-12: Implementation of Binary Search trees operations: create, Inorder, Preorder, Postorder.
Excercise-13: Implementation of Heaps through C code.
Excercise-14: Develop C code to demonstrate Breadth First Search Techniques.
Excercise-15: Develop C code to demonstrate Depth First Search Techniques.

Course Outcomes: After completing this course, Students will be able to-

CO 1: Implement the data structures with the basic level knowledge.
CO 2: Design and analyze the time efficiency of the data structure.
CO 3: Design and analyze the Space efficiency of the data structure in the memory.
CO 4: Identifies the appropriate data structure for given problem.
CO 5: Compare and Contrast various data structures and design techniques in the area of Performance.

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I Year – II Semester

L	T	P	C
0	0	3	1.5

ENGINEERING WORK SHOP

Course Objective: To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint
b) Dovetail joint
c) Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Dovetail fit c) square fit d) Semi-circular e) Two Wheeler tyre puncture and change of two wheeler tyre

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light
e) Three phase motor f) Soldering of wires

Course Outcomes: After completion of this lab the student will be able to

1. Apply wood working skills in real world applications. (L3)
2. Build different parts with metal sheets in real world applications. (L3)
3. Apply fitting operations in various applications. (L3)
4. Apply different types of basic electric circuit connections. (L3)
5. Demonstrate soldering and brazing. (L2)

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I Year – II Semester

L	T	P	C
3	0	0	0

ENVIRONMENTAL STUDIES
(Common to CE, CSE & IT)

OBJECTIVE:

To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life to save earth from the inventions by the engineers.

UNIT – I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II: Ecosystems, Biodiversity, and its Conservation

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION : Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III: Environmental Pollution and Solid Waste Management

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution

f. Thermal pollution
g. Nuclear hazards

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV: Social Issues and the Environment

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V: Human Population and the Environment

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

TEXT BOOKS:

1. Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Palaniswamy – Pearson education
3. Environmental Studies by Dr.S.AzeemUnnisa, Academic Publishing Company

REFERENCES:

1. Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
2. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3. Comprehensive Environmental studies byJ.P.Sharma, Laxmi publications.
4. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5. A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

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

COURSE OUTCOMES

CO1 Able to U**nderstand** The concepts of the ecosystem

CO2 Able to U**nderstand** The natural resources and their importance

CO3	Able to learn The biodiversity of India and the threats to biodiversity ,and **Apply** conservation practices
CO4	Able to learn Various attributes of the pollution and their impacts
CO5	Able to U**nderstand** Social issues both rural and urban environment
CO6	Able to U**nderstand** About environmental Impact assessment and **Evaluate** the stages involved in EIA

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II Year I Semester

L	T	P	C
2	1	0	3

COMPLEX VARIABLES AND STATISTICAL METHODS

Pre-Requisites:

1. Calculus
2. Partial Differentiation
3. Multiple Integration
4. Set Theory

Course objectives: The student should be able to

1. Familiarize the complex variables.
2. Familiarize the students with the foundations of probability and statistical methods.
3. Equip the students to solve application problems in their disciplines.

Unit-1 Functions of complex variable and complex integration: (05 hrs)

Introduction – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne-Thompson method.

Complex integration: (05 hrs)

Line integral – Cauchy's integral theorem – Cauchy's integral formula. (all without proofs).

Unit-2 Series expansions and Residue Theorem: (05 hrs)

Radius of convergence – Expansion in Taylor's series, Maclaurin's series - Laurent's series.

Types of singularities: (05hrs)

Isolated – pole of order m – Essential – Residues – Residue theorem (without proof)

Unit-3 Probability, Distributions and Sampling Theory: (07 hrs)

Probability-Baye's theorem-Random variables-Discrete and Continuous random variables-Distribution function-Mathematical Expectation and Variance

Application approach: (07 hrs)

Binomial, Poisson and Normal distributions, Population and samples-Sampling distribution of Means -Point and Interval estimations, **Applications: Maximum error of estimate – Bayesian estimate**

Unit-4 Test of Hypothesis: (14 hrs)

Introduction–Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of significance-One tail and two-tail tests-Tests concerning one mean and two means (Large and Small samples)-Tests on proportions.

Applications: Chi-square test and F-test on small samples.

Unit-5 Curve fitting and Correlation: (12 hrs)

Method of least squares-Straight line-Parabola-Exponential-Power curves-Correlation-Correlation coefficient-Rank correlation-Regression coefficient and properties-Regression lines.

Multiple regressions

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

CO1: Cauchy-Riemann equations to complex function in order to determine whether a given continuous function is analytic (**Apply**)

CO2: The differentiation, integration of complex functions used in engineering problems and make use of Cauchy residue theorem to evaluate certain integrals (**Apply**)

CO3: Discrete and continuous probability distributions and design the components of a classical hypothesis test **(Apply & Create)**

CO4: The statistical inferential methods based on small and large sampling tests. **(Analyze)**

CO5: Interpret the association of characteristics and through correlation and regression tools. **(Analyze)**

Text books:

1. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11/e (Reprint) 2019, Sultan Chand & Sons Publications.

Reference books:

1. Miller and Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2. T. K. V. Iyenger, Probability and Statistics, S. Chand & Company Ltd, 2015.
3. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.

e- Resources & other digital material:

1. https://www.youtube.com/watch?v=Mwpz1zjPlzI&list=PLbMVogVj5nJS_i8vfVWJG16mPcoEKMuWT (For Complex Variables)
2. https://www.youtube.com/playlist?list=PLiUVvsKxTUr66oLF6Pzirc1EgSstMbRZR (For Complex Variables from 1-13)
3. https://www.youtube.com/watch?v=COI0BUmNHT8&list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE (For Probability and Statistics)
4. https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB (For Probability and Statistics)
5. https://www.mathsisfun.com/data/standard-normal-distribution-table.html (Information about Normal distribution)
6. https://www.statisticshowto.com/tables/t-distribution-table/(Information about T-distribution)

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II Year I Semester

L	T	P	C
3	0	0	3

ELECTRICAL MACHINES-1

Pre-Requisites: Basic Electrical Circuits

Course objectives: The student should be able to

1. Understand the unifying principles of energy conversion and DC Generator.
2. Understand the significance of Back EMF and Production of Torque in DC Motor.
3. Learn the characteristics, performance, methods of speed control and testing methods of DC motors.
4. Predetermine the performance of single phase transformers with equivalent circuit models.
5. Understand the parallel operation of transformers and three-phase to two-phase Conversion.

Unit-1 Electromechanical Energy Conversion :Principles of electromechanical energy conversion – singly excited-concept of co-energy -Force and torque derivation - multi excited system(qualitative treatment)

Introduction to DC Generator: Construction and principle of operation of DC machine – EMF equation– Classification of DC machines based on excitation – OCC of DC shunt generator-Determination of Critical resistance and critical speed- Armature reaction and commutation -Numerical problems. (10 hrs)

Unit-2 Performance of D.C. Motor: Torque and back-EMF equation of dc motor– characteristics of shunt, series and compound motors - losses and efficiency- applications of dc motors- Numerical problems. (10 hrs)

Unit-3 Starting, Speed Control of DC Motor: Necessity of starter –3 point and 4 point starters – Speed control of Shunt motor by armature voltage and field control. (04 hrs)

Testing of D.C. Machines: Testing methods - Swinburne's Test –Hopkinson's Test -Brake Test on Shunt Motor–Load test on shunt generator-Numerical problems. (08 hrs)

Unit-4 Single-phase Transformers: Principle of operation-Constructional details - EMF equation - operation on no load and on load - phasor diagrams. (04 hrs)

Equivalent circuit and performance :

Equivalent circuit –Voltage regulation – losses and efficiency –effect of variation of frequency and supply voltage on losses – All day efficiency-Numerical problems. (08 hrs)

Unit-5 Single phase Transformer Testing: Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test -separation of losses – parallel operation with equal voltage ratios- Auto Transformer-comparison with two winding transformers-Numerical problems. (07 hrs)

Three Phase Transformers: Poly phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ-Scott connection. (03 hrs)

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

CO1: Understand the concepts of energy conversion and principle operation of DC Generator. **(Understand)**

CO2: Examine the significance of Back EMF and Production of Torque in DC Motor. **(Apply)**

CO3: Analyze the speed control methods and performance of DC Machine. **(Analyze)**

CO4: Quantify the performance of single phase transformers. **(Evaluate)**

CO5: Empathise parallel operation of transformers and three-phase to two-phase Conversion. **(Understand)**

Text books:

1. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria& Sons
2. Electrical Machines – P.S. Bhimbra, Khanna Publishers

Reference books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGrawHill Publications, 4th edition
2. Electrical Machinery by Abijith Chakrabarthi and Sudhipta Debnath, McGraw Hill education 2015
3. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010
4. Electric Machinery by A.E. Fitzgerald, Charleskingsley, Stephen D.Umans, TMH.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/105/108105017/
2. https://nptel.ac.in/courses/103/102/108102146/
3. www.nptelvideos.in/2012/11/electrical-machines-i.html
4. https://nptel.ac.in/courses/108/105/108105017/

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II Year I Semester

L	T	P	C
2	0	0	2

PYTHON PROGRAMMING

Pre-Requisites: Nil

Course objectives: The student should be able to

1. To introduce the concepts of Python programming and build scripts using python language constructs, and control structures.
2. To impart knowledge of data structures in python and their application in real-time scenarios.
3. To introduce the concept of reusability using functions.
4. To introduce the concepts of OOPs in python programming.
5. To develop the concepts of interfacing hardware modules and building real-time systems using python and Raspberry Pi.

Unit-1 Introduction to Python (16hrs)

Introduction: History of Python, Need of Python Programming, Introduction to Object-oriented Programming, Comparison with Modular Programming, Python Programming Basics, Sample programs, Data types and operators, Strings and Characters, Control statements, Expressions and order of evaluation, Arrays

Unit-2 OOPS &Data Structures (12hrs)

OOPS: Introduction, OOPs principles, Classes, Objects, Functions, Arguments & their types. Self variables and static keyword, Constructor Overloading, Lambda functions.

Data Structures: Lists - Operations, Slicing, Methods; Tuples. Sets, Dictionaries, Sequences, Comprehensions

Unit-3 Inheritance, Exceptions& Modules (14hrs)

Inheritance: Introduction, Types of Inheritance, Overriding, Access modifiers, Abstract Classes, Interfaces.

Exception Handling: Error Vs Exception, Exception handling in python, Exception Hierarchy, usage of try, catch, throw. User Defined Exceptions.

Modules: Creating modules, import statement, from. Import statement, name spacing, Using Python Packages like OS, Math, Date time, Regular Expressions.

Unit-4 Data & File Handling (10hrs)

Data Handling: Math, Numpy Library, scipy and Matplotlib - Loading the library and importing the data, How Mat plot lib works, modifying the appearance of a plot, Plotting multiple plots, Modifying the tick marks, Scatter plots, Bar plots.

File Input Output: Introduction to files, File I/O handling – File Operations, Random Access file**.**

Unit-5 Interfacing with Raspberry Pi (14hrs)

Python programming on Raspberry Pi :: Basic features, Raspberry Pi2B, Raspberry Pi3B, Raspberry Pi3B+ and Raspberry Pi4B, System setup and booting – Steps involved in making the raspberry pi board ready for use. Introduction to Raspbian Operating system, basic commands – Creating, deleting files, directories, listing files and directories, Python IDE on Raspberry Pi, Accessing the board, Basic I/O – Reading analog, digital inputs.

Interfacing with Raspberry Pi: Purpose of datasheets, Interfacing – LED, 7-segment display, Ultrasonic sensor, Passive Infrared (PIR) sensor, interfacing a camera module with Raspberry Pi.

(Programming using Python)

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

CO1: Identify the basic python constructs with a view of using them in problem solving.**(Remember, Understand, and Apply)**

CO2: Apply control structures and use python lists in examples of problem solving.**(Understand, Apply, Analyze and Evaluate)**

CO3: Explore the utility of functions in modular programming using python. (**Apply, Analyze, valuate, and create)**

CO4: Apply the concepts of Object Oriented Programming to solve the real-time problems. **(Understand, Apply, Analyze)**

CO5: Interface hardware components with Raspberry Pi using Python APIs. **(Understand, Apply, Analyze and create)**

Text books:

1. R. Nageswara Rao, "Core python programming", 2nd Edition, Dreamtech, 2017.
2. Python Programming using problem solving Approach by Reema Thareja, 1st Edition, Oxford University Higher Education, 2017
3. Povel Solin, Martin Novak, "Introduction to Python Programming", NC Lab Public Computing, 2013.
4. Programming the Raspberry Pi: Getting Started with Python, 2nd Edition, Simon Monk, 2015.

Reference books:

1. Jacob Fredslund, "Introduction to Python Programming" 2007.
2. Y. Daniel Liang, "Introduction to programming using python", 1st Edition Pearson, 2017.
3. Bill Lubanovic, "Introducing Python - "Modern Computing in Simple Packages", 1st Edition, O'ReillyPublication, 2015.
4. Mark Summerfield, "Programming in Python 3" 2nd Edition, Pearson Education, 2010.
5. Magnus Lie Hetland, "Beginning Python –From Novice to Professional", APress Publication, 2017.

e- Resources & other digital material:

The official Raspberry Pi Beginner's Guide How to use your new computer, Gareth Halfacree. Available Online: https://www.raspberrypi.org/magpi-issues/Beginners_Guide_v1.pdf.

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II Year I Semester

L	T	P	C
2	0	0	2

ELECTRICAL CIRCUIT ANALYSIS

Prerequisites: Basic Circuit Analysis,
Integrations,
Laplace transforms and
Differential equations

Course Objectives:

1. To study the concepts of balanced and unbalanced three-phase systems.
2. To study the transient behaviour of electrical circuits with DC excitation
3. To study the transient behavior of electrical circuits with AC excitation.
4. To study the analysis of two port network
5. To understand the concept of Network synthesis.

Unit-1 Three Phase Systems

Types of three phase systems - Phase sequence- relation between line and phase voltages and currents - analysis of balanced three phase systems - Analysis of three phase unbalanced systems: Loop method – Milliman's method.

Unit-2 Transient Analysis in DC circuits

Transient response of R-L, R-C, R-L-C circuits for DC excitation, Solution using differential equations and Laplace transforms

Unit-3 Transient Analysis in AC circuits

Transient response of R-L, R-C, R-L-C circuits for pulse and AC excitations, Solution using differential equations and Laplace transforms.

Unit-4 Two port Networks

Two port network parameters – Z, Y, ABCD and Hybrid parameters and their relations, Cascaded networks

Unit-5 Network Synthesis

Positive real function - basic synthesis procedure - LC immittance functions - RC impedance functions and RL admittance function - RL impedance function and RC admittance function - Foster and Cauer methods

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

CO1: Various electrical three phase networks under balanced and unbalanced loads with different methods

CO2: Transient response of various electrical networks with DC excitation.

CO3: Transient response of electrical networks with AC excitation.

CO4: Various Two port network parameters and their mutual relations

CO5: Synthesis procedure for drawing equivalent electrical network for a given transfer functions.

Text books:

1. Circuits & Networks Analysis & Synthesis by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill.
2. Circuit Theory by A.Chakrabarti Danapat Rai & Co publisher.

Reference books:

1. "Fundamentals of Electric Circuits" Charles K.Alexander, Mathew N.O.Sadiku, Tata McGraw-Hill.
2. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,Mc Graw Hill Company,6th edition
3. Network synthesis: Van Valkenburg; Prentice-Hall of India Private Ltd
4. 3000 Solved Problems in Electrical Circuit by Schaum's solved problem series Tata McGraw- Hill.
5. Network Analysis by N.C.Jagan, C.Lakshmi Narayana BS publications 2nd edition

e- Resources & other digital material

1. https://www.youtube.com/watch?v=MHwM1C1zUz4
2. https://www.youtube.com/watch?v=xaeob9lTXS0
3. https://www.youtube.com/watch?v=GasWAlIvvD8&list=PL16EE39765482C57F
4. https://www.youtube.com/watch?v=2D_eGLGcUXQ&list=PL16EE39765482C57F&index=5
5. https://www.youtube.com/watch?v=UltkCsoh6Bw&list=PL16EE39765482C57F&index=7

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II Year I Semester

L	T	P	C
3	0	0	3

BASIC ELECTRONIC DEVICES AND CIRCUITS

Pre-Requisites: Engineering Physics

Course objectives:

1. To Understand the Diode operation and switching characteristics,
2. To understand the implementation of various diode applications
3. To Understand the Operation of BJT, FET, MOSFET metal semiconductor rectifying and ohmic contacts.
4. To learn the various biasing methods and small-signal models of Transistors
5. To learn the feedback topology of amplifier and applications of transistors.

Unit-1 Junction Diode Characteristics (12 Hrs)

Review of semiconductor Physics, P-N Junction Diode Qualitative Theory of P-N Junction, P-N Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of VI characteristic, Ideal versus Practical – Resistance levels (Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis, Breakdown Mechanisms in Semiconductor Diodes.

Special Diodes

Zener Diode Characteristics, Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, LED and Photo Diode.

Unit-2 Diode Applications **(10 Hrs)**

Half wave rectifier, ripple factor, full wave rectifier, Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L - section filter, Pi - section filter, Multiple L and pi - section and filter, and comparison of various filter circuits in terms of ripple factors, Simple circuit of a regulator using zener diode, Series and Shunt voltage regulators, Applications of rectifiers and voltage regulators.

Unit-3 Bi-polar Junction Transistors(BJT) (06 Hrs)

Formation of N-P-N and P-N-P transistors, Transistor current components, Operation of BJT, BJT characteristics (CE, CB, CC configurations), Early effect, Current equations, Relation between Alpha and Beta, typical transistor junction voltage values and Limits of Operation, Transistor as an amplifier.

Junction Field Effect Transistors(JFET) (03 Hrs)

Junction Field Effect Transistor (JFET) structure, Drain and Transfer Characteristics, Significance of Pinch-Off Voltage, JFET as an amplifier and switch, Comparison of BJT and JFET.

Metal-Oxide-Semiconductor Field Effect Transistors (MOSFET) (03 Hrs)

Structure of Depletion-MOSFET and Enhancement-MOSFETs, V-I Characteristics of MOSFET, Significance of threshold voltage.

Unit-4 Biasing and Stabilisation (06 Hrs)

Need for Proper Biasing, Q-point stability, Fixed, Collector to Base bias and Voltage Divider biasing for BJT, Emitter Degeneration, Design of Self Biasing circuit, Thermal Stability considerations. Fixed, Voltage Divider biasing for JFET and MOSFETs.

Small Signal Low frequency analysis of BJT and FET amplifiers (06 Hrs)

Small signal low frequency h-parameter model of BJT. Approximate model, Analysis of BJT amplifiers using Approximate model for CB, CE and CC configurations, Analysis of JFET Amplifiers,

Analysis of CS, CD JFET Amplifiers.

Unit-5 Feedback Amplifiers (05 Hrs)

Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on input and output characteristics, Voltage series, voltage shunt, current series, and current shunt feedback amplifiers with discrete components and their analysis

Oscillators (05 Hrs)

Condition for oscillations. RC-phase shift oscillators with Transistor and FET, Hartley and Colpitts oscillators, Wein bridge oscillator, Crystal oscillators, Frequency and amplitude stability of oscillators.

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

CO1: Develop through basic knowledge on the behavior and the characteristics of semiconductor junction. **(Understand)**

CO2: Demonstrate the usage of diodes in various applications **(Apply)**

CO3: Acquire knowledge on the operations of BJT, FET, and MOSFET. **(Understand)**

CO4: Learn the art of biasing of BJTs and FETs, small signal low frequency models of BJTs and FETS in amplifier analysis **(Apply, Analyze)**

CO5: Learn the feedback topology of amplifier and applications of transistors **(Apply, Analyze)**

Text books:

1. Jacob Millman and Halkias , ‘ Integrated Electronics’, Tata-Mcgraw Hill International 1991.
2. Donald A. Neaman,”Semiconductor Physics and Devices”, Times Mirror High Education Group, Chicago, 1997.

Reference books:

1. Robert L.Boylestead and Louis Nashelsky,”Electronic Devices and Circuit Theory”,Pearson Education Inc.Eleventh Edition 2013
2. Adel S. Sedra and Kenneth C. Smith, “ Microelectronic Circuits”, Oxford University Press, 2004 Edition.
3. D. Chattopadhyay and P.C. Rakshit Electronics: Fundamentals and Applications.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/117/102/117102061/
2. https://nptel.ac.in/courses/117/106/117106091/
3. https://nptel.ac.in/courses/108/107/108107142/

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II Year I Semester

L	T	P	C
2	1	0	3

ELECTROMAGNETIC FIELDS

Pre-Requisites:

1. Complex numbers
2. Vector Analysis
3. Co-ordinate Geometry
4. Basic circuit Analysis

Course objectives: The student should be able to

1. Study the electric field and potentials due to different configurations of static charge and Maxwell's first equation
2. Study the behavior of conductors and dielectrics, evaluation of capacitance for different configurations.
3. Study the Biot Savart's Law, Ampere Circuital Law and applications
4. Study the Lorentz force equation
5. Understand the concept inductance and time varying fields

Unit-1 Electrostatic Fields: Coulomb's Law ,Electric Field Intensity (EFI) ,EFI due to a line, surface and volume charge, Work done in moving a point charge in an electrostatic field, Electric Potential , Properties of potential function, Potential gradient, Gauss's law, Application of Gauss's Law, Maxwell's first law, Laplace's and Poison's equations, Solution of Laplace's equation in one variable. **(10 hr)**

Unit-2 Dielectrics and Capacitance: Electric dipole, Dipole moment, Potential and EFI due to an electric dipole, Torque on an Electric dipole in an electric field, Behavior of conductors in an electric field, Electric field inside a dielectric material, Polarization, Dielectric – Conductor and Dielectric – Dielectric boundary conditions, Capacitance, Capacitance of parallel plate and spherical and co-axial capacitors with composite dielectrics, Energy stored and energy density in a static electric field, Current density, Conduction and Convection current densities, Ohm's law in point form – Equation of continuity. **(10 hrs)**

Unit-3 Static magnetic fields: Biot-Savart's law, Magnetic field intensity (MFI), MFI due to a straight current carrying filament, MFI due to circular, rectangular, square and solenoid current Carrying wire, Maxwell's second Equation, Ampere's circuital law and its applications, MFI due to an infinite sheet of current and a long current carrying filament, Differential form of Ampere's circuital law (Maxwell's third equation). **(10 hrs)**

Unit-4 Force in Magnetic fields: Magnetic force on Moving charges in a Magnetic field, Lorentz force equation, Force on a current element in a magnetic field, Force on a straight and a long current carrying conductor in a magnetic field, Force between two straight long and parallel current carrying conductors, Magnetic dipole and dipole moment, A differential current loop as a magnetic dipole, Torque on a current loop placed in a magnetic field. **(10 hrs)**

Unit-5 Inductance: Self and Mutual inductance, Determination of self-inductance of a solenoid and toroid, Mutual inductance between a straight long wire and a square loop wire in the same plane,

Energy stored and density in a magnetic field. (05 hrs)

Time varying fields: Faraday's laws of electromagnetic induction, Integral and point forms, Maxwell's fourth equation, Statically and dynamically induced EMFs, Modification of Maxwell's equations for time varying fields, Displacement current, Poynting Theorem and Poynting vector. **(05 hrs)**

Course Outcomes: Upon successful completion of the course

CO1: The student will be able to calculate the electric field and potentials using Gauss's law and Laplace equation

CO2: The student will be able to evaluate capacitance for different configurations

CO3: The student will be able to find magnetic field intensity of different configurations using Biot-Savart's law and Ampere's law

CO4: The student will be able to calculate magnetic forces and torque produced by currents in magnetic fields

CO4: The student will be able to quantify inductance and evaluation of induced EMF in time varying fields

Text books:

1. "Elements of Electro Magnetics" by Matthew N.O.Sadiku, Oxford Publications, 7th edition
2. "Engineering Electro Magnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill Companies, 7th Editon.2006.

Reference books:

1. "Electro Magnetic Fields" by Dr.Y.Mallikarjuna Reddy, Universities Press.
2. "Introduction to Electro Dynamics" by D J Griffiths, PHI Pvt. Ltd, 2nd editon.
3. "Electro Magnetics" by J. D Kraus Mc Graw-Hill Inc. 4th edition 1992.
4. "Electro Magnetic Theory" by U.A. Bakshi and A.V.Bakshi, Technical Publications

e- Resources & other digital material

1. https://www.sciencedirect.com/topics/medicine-and-dentistry/electromagnetic-field
2. https://phys.libretexts.org/
3. https://nptel.ac.in/courses/108/106/108106073/
4. https://nptel.ac.in/courses/117/103/117103065/
5. https://nptel.ac.in/courses/108/104/108104087/
6. https://nptel.ac.in/courses/115/101/115101005/

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II Year I Semester

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PYTHON PROGRAMMING LAB

Prerequisites: Knowledge of any programming language

Course Objectives:

1. Experiment with scripting language
2. Evaluate expression evaluation, control statements
3. Use Data structures
4. Model Functions, Modules and packages
5. Outline OOP through Python and Exception Handling
6. Select required Python Standard Library for GUI

Course Outcomes:

CO-1: Demonstrates the use of an interpreted language for problem solving through control statements including loops and conditionals.

CO-2: Practice with data structures for quick programming solutions.

CO-3: Demonstrates software building for real needs through OOPS approach.

CO-4: Comprehend functions and modules & exception handling.

CO-5: Use of python standard libraries to handle IOT based applications.

LIST OF EXPERIMENTS

PART – A: SOFTWARE

(Students must perform Any 15 experiments from the following list)

1. Write a program to compute distance between two points taking input from the user (Using Pythagorean Theorem)
2. Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
3. Write a Program for checking whether the given number is a even number or not.
4. Write a program to identify the quadrant of a given angle using elif control statement.
5. Write a Program to set the password considering string length not less than six characters using for loop within a chance of limit given as 5.
6. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
7. Find the sum of all the primes below two million.
8. Considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.
9. Write a program to count the numbers of characters in the string and store them in a dictionary data structure
10. Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.
11. Write a program to print each line of a file in reverse order.
12. Write a program to compute the number of characters, words and lines in a file.
13. Find mean, median, mode for the given set of numbers in a list.
14. Write a function dups to find all duplicates in the list.
15. Write a function unique to find all the unique elements of a list.

16. Write a function cumulative_product to compute cumulative product of a list of numbers.
17. Write a function reverse to reverse a list. Without using the reverse function.
18. Implement Bank account of a customer with data members: acno, account holder name, account type, balance. Implement necesssary methods like set(), get(), withdraw() and deposit().
19. Implement addition, subtraction operations on a complex number using Python classes.
20. Implement a simple program to demonstrate Exceptions in python.

PART – B: HARDWARE

(Students must perform Any 5 experiments from the following list)

1. Design and implement a system that measures the distance between an object and current position using Raspberry Pi 4B.
2. Design and implement a system that can detect and alert movement of an object/person using Raspberry Pi 4B.
3. Design and implement a system that measures the temperature of the room using Raspberry Pi 4B.
4. Interface an LED and a 7-Segment display to a Raspberry Pi 4B board.
5. Interface a relay switch to Raspberry Pi board and demonstrate its operation.
6. Interface a camera module and store an image/video in a specific location on Raspberry Pi 4B board.

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II Year I Semester

L	T	P	C
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ELECTRICAL CIRCUIT ANALYSIS LAB

Prerequisites: Basic Circuit Analysis, Electrical Circuit Analysis

Course Objectives:

1. To analyze different circuits using network theorems.
2. To analyse two port network parameters.
3. To understand the resonance condition of AC circuits
4. To determine the self and mutual inductance of coupled circuit.
5. To acquire skills of electrical circuit studies using MATLAB.

LIST OF EXPERIMENTS

Any ten experiments from the following

1. Verification of Thevenin's and Norton's Theorems.
2. Verification of Superposition theorem and Reciprocity theorem
3. Verification of Maximum Power Transfer Theorem.
4. Verification of Compensation Theorem.
5. Verification of Millmann's Theorem.
6. Verification of series Resonance of AC circuit.
7. Determination of Choke coil parameters
8. Determination of Z and Y Parameters of a network
9. Determination of Transmission and hybrid parameters of a network
10. Determination of self inductance and mutual inductance of coupled circuit
11. Simulation of mesh analysis of electrical network.
12. Simulation of nodal analysis of electrical network.
13. Simulation of determining form factor, peak factor of sinusoidal wave, square wave.
14. Simulation of parallel resonance of AC circuit.
15. Simulation of Verification of Kirchhoff's current law and voltage law

Course Outcomes:

Students are able to

1. Understand network theorems for different circuits.
2. Evaluate the two port network parameters
3. Examine the resonance condition of AC circuits
4. Determine the self and mutual inductance of coupled circuits.
5. Analyse electrical circuits using software.

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II Year I Semester

L	T	P	C
0	0	3	1.5

BASIC ELECTRONIC DEVICES AND CIRCUITS LAB

Course Objectives:

1. To study basic electronic components
2. To observe characteristics of electronic devices

Learning Outcomes: At the end of the course the students can able to

1. Measure voltage, frequency and phase of any waveform using CRO.
2. Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
3. Analyze the characteristics of different electronic devices such as diodes, transistors etc.
4. Analyze and design simple circuits like rectifiers, power supplies and amplifiers etc.,

Electronic Workshop Practice:

1. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
2. Soldering Practice- Simple circuits using active and passive components.
3. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Millimeter, Function
4. Regulated Power Supply and CRO.

List of Experiments

Any 10 of the following experiments are to be conducted

1. P.N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias& Reverse bias)
   Part B: Silicon Diode (Forward Bias only)
2. Zener Diode Characteristics
   Part A: V-I Characteristic
   Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with c-filter)
   Part A: Half-wave Rectifier
   Part B : Full-wave Rectifier
4. BJT Characteristics (CE Configuration)
   Part A: Input Characteristics
   Part B: output Characteristics
5. FET Characteristics
   Part A: Drain Characteristics
   Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurement
10. BJT-CE Amplifier
11. Emitter Follower –CC Amplifier
12. Design any oscillator and measure frequency (RC PHASE SHIFT, WEIN BRIDGE, HARTLEY, and COLPITT'S)
13. Design of variable DC power supply (application).

II Year I Semester

L	T	P	C
2	0	0	0

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Pre-Requisites: Nil

Course objectives: To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

1. The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
2. To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
3. The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.
4. To know the student traditional knowledge in different sector.

Unit-1 Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

Unit-2 Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Unit-3 Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

Unit-4 Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Unit-5 Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

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

CO1: understand the concept of Traditional knowledge and its importance

CO2: Know the need and importance of protecting traditional knowledge.

CO3: Understand legal framework of TK, Contrast and compare the ST and other traditional forest dwellers

CO4: Know the various enactments related to the protection of traditional knowledge.

CO5: Understand the concepts of Intellectual property to protect the traditional knowledge

Text books:

1. Traditional Knowledge System in India, by Amit Jha, 2009
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

e- Resources & other digital material:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

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II Year II Semester

L	T	P	C
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LINEAR IC APPLICATIONS

PRE-REQUISITES: Basics of Electronic Devices, KCL, KVL& Network Theorems

Course objectives:

- To understand the basic operation and performance parameters of differential amplifier and operational amplifier.
- To learn the linear and non-linear applications of operational amplifier.
- To understand the analysis & design of different types of active filters using Op-Amps.
- To learn the internal structure, operation and applications of different IC's.
- To understand the various types of Digital to Analog and Analog to Digital converters

Unit-1 Differential Amplifier and Operational Amplifier Characteristics: [13 hours]

Analysis of Differential Amplifier using BJTs: DC & AC analysis of all the four configurations, Types of Integrated circuits: packages, temperature ranges and power supplies.

Basic block diagram of Operational Amplifier, Symbol of operational amplifier, operational amplifier ideal characteristics and specifications of IC 741, DC&AC characteristics of operational Amplifier: input bias current, input offset current, input offset voltage, Drift, Slew rate, CMRR, PSRR; pin diagram of IC 741,equivalent diagram of operational amplifier.

Unit-2 Linear and Non-Linear applications of Operational Amplifier: [13 hours]

Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, Log and Anti log Amplifiers, Precision rectifiers. Comparators, Multivibrators, Triangular and Square wave generators.

Unit-3 Active Filters, Analog Multipliers and Modulators:

Design & Analysis of Butter worth active filters –1storder, 2ndorder LPF, HPF filters. Band pass, Band reject and all pass filters. Four Quadrant Multiplier, IC 1496, Sample &Hold circuits.

Unit-4 Timers & Phase Locked Loops:

Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger. PLL- introduction, block schematic, Principles and description of individual blocks,565 PLL, Applications of PLL-Frequency Multiplication, frequency translation, Applications of VCO (566).

Unit-5 Data Converters and Applications:

Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Sample and Hold circuit, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC. DAC and ADC Specifications, illustrative problems on resolution of ADC and DAC.

Course Outcomes

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

CO1: Explain the DC and AC analysis of Differential Amplifier, and performance parameters of OP-Amp**{Understand level, KL2}**

CO2: Demonstrate the usage of operational amplifier in various applications **{Apply level, KL3}**

CO3: Explain the working principles of Active filters, Multipliers and Modulators using Op-Amp.**{Understand level, KL2}**

CO4: Learn the internal structure, pin diagrams and operations of different IC's **{Apply level, KL3}**

CO5: Learn the circuits of data converters and **Compare** among them in terms of Parameters**{ Apply level, KL3Analyze level, KL4}**

Text books:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1987.
3. Linear Integrated Circuits by Salivahan-3rd-Edition, McGrawHill,2018

Reference books

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma;SKKataria&Sons;2nd Edition,2010
2. Design with Operational Amplifiers & Analog Integrated Circuits – Sergio Franco, McGraw Hill, 1988.
3. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition,2011.
4. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992

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II Year II Semester

L	T	P	C
2	1	0	3

ELECTRICAL MACHINES - II

PRE-REQUISITES: 1) Electrical Machines-I

Course objectives: The student should be able to

- Understand the principle of operation and performance of 3-phase induction motor.
- Quantify the starting and speed control of induction motor.
- Study the mechanism of torque producing and starting methods of a single-phase Induction Motor.
- Understand the Principle, Voltage Regulation and Parallel operation of synchronous generator.
- Understand the operation, performance and starting methods of synchronous motor.

Unit-1: 3-phase Induction Motors:

Constructional details of cage and wound rotor machines - production of rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor current and pf at standstill and during running conditions - rotor power input, rotor copper loss and mechanical power developed and their interrelationship – equivalent circuit – phasor diagram-Numerical Problems. **(10 hrs)**

Unit-2 Characteristics of Induction Motors:

Torque equation -expressions for maximum torque and starting torque - torque slip characteristics - crawling and cogging. **(04 hrs)**

Starting and Testing methods of Induction Motors:

No load and blocked rotor tests - circle diagram for predetermination of performance–Numerical Problems-Methods of starting (Auto-Transformer and DOL Starters) - Speed control using V/f method. **(10 hrs)**

Unit-3 Single Phase Motors:

Single phase induction motors– Constructional features -Problem of starting–Double revolving field theory–Equivalent circuit. **(04 hrs)**

Starting methods of single phase Induction motor - shaded pole motors-A.C Series Motor. **(04 hrs)**

Unit-4 Synchronous generator:

Constructional features of non–salient and salient pole type–E.M.F equation—Voltage regulation by synchronous impedance method– MMF method and Potier triangle method– phasor diagrams– Two reaction analysis of salient pole machines and phasor diagram. **(08 hrs)**

Parallel operation of synchronous Generators: Parallel operation with infinite bus and other alternators-Synchronizing power – Load sharing-Numerical problems. **(05 hrs)**

Unit-5 Synchronous motor operation, starting and performance:

Principle operation– Phasor diagram –Variation of current and power factor with excitation –Methods of starting -Hunting and its suppression methods-Synchronous condenser-Applications- Numerical

problems. **(08 hrs)**

Course Outcomes

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

CO1: Explain the operation and performance of three phase induction motor.**{Knowledge level, KL1}**

CO2: Analyse the torque-speed relation, starting and speed control of induction motor. **{Analyze level, KL4}**

CO3: Describe the torque production and starting methods of single-Phase induction motor. **{Knowledge level, KL1}**

CO4: Empathise the Principle, Voltage Regulation and Parallel operation of synchronous generator. **{Understand level, KL2}**

CO5: Realize the operation, performance and starting methods of synchronous motor. **{Analyze level, KL4}**

Text books:

1. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria& Sons
2. Electrical Machines – P.S. Bhimbra, Khanna Publishers .

Reference books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth,McGrawHill Publications,4th edition.
2. Electrical Machinery by AbijithChakrabarthi and SudhiptaDebnath,McGraw Hill education 2015.
3. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010.
4. Electric Machinery by A.E.Fitzgerald,Charleskingsley,StephenD.Umans, TMH.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/105/108105131/
2. https://nptel.ac.in/courses/108/106/108106072/
3. www.nptelvideos.in/2012/11/electrical-machines-ii.html
4. *https://nptel.ac.in/courses/108/106/108106023/*

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II Year II Semester

L	T	P	C
2	1	0	3

CONTROL SYSTEMS

Prerequisites: Laplace Transforms, Differential equations, Matrix Algebra, Basic Circuit Analysis

Course Objectives:

1. To learn the mathematical modeling of electrical and mechanical systems
2. To analyze the time response of first and second order systems
3. To investigate the stability using Routh's stability criterion and Root locus.
4. To investigate the stability using Bode plot and Nyquist criterion.
5. To formulate state models and the concepts of Controllability and Observability

Unit-1 Mathematical Modeling of Control Systems: Introduction to control systems, Classifications - Open Loop and closed loop, transfer function, Mathematical Modelingof electrical networks, Translational and Rotational systems, analogous systems, Transfer Function of DC & AC Servo motor-Synchros, -Block diagram algebra – Signal flow graph - Mason's gain formula. (**15 Hrs**)

Unit-2 Time Response Analysis: Standard test signals - Time response of first and second order systems - Time domain specifications - Steady state errors and error constants –Effects of Feed-Back-Dominant Closed loop poles- PD - PI- PID controllers . (**10Hrs**)

Unit-3 Stability and Root locus Technique: The concept of stability – Routh's stability criterion Procedure and problems –limitations of Routh's stability –Root locus concept - construction of root loci –Effect of Adding open loop poles and Zeros on Root Loci . (**10Hrs**)

Unit-4 Frequency Response Analysis: Introduction - Frequency domain specifications-Bode diagrams-transfer function from the Bode Diagram-Polar Plots, Nyquist Stability criterion- relative stability analysis- Phase margin and Gain margin- Characteristics of Lag, Lead and Lag-Lead compensators. (**15 Hrs**)

Unit-5 State Space Analysis: Concepts of state, state variables, state equation and state model, state space modeling of control systems, Solution of the state equation- State Transition Matrix and it's Properties - Transfer function from state model (**10Hrs**)

Course Outcomes

The students are able to

CO1: Derive the transfer function using block diagram algebra and signal flow graph.**{Apply level, KL3}**

CO2: Determine time response specifications of second order systems and Error constants.**{Apply level, KL3}**

CO3: Analyze stability using Routh's stability criterion and the root locus method.**{ Analyze level, KL4}**

CO4: Analyze the stability using Bode plot and Nyquist criterion.**{ Analyze level, KL4}**

CO5: Obtain state models and understanding the concepts of Controllability and Observability.**{Apply level, KL3& Understand level, KL2}**

Text books:

1. ControlSystems Engineering - I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition.
2. Automatic control systems - Benjamin C.Kuo, Prentice Hall of India,2nd Edition.

Reference books:

1. Control Systems principles and design-M.Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition.
2. Modern Control Engineering- Kotsuhiko Ogata, Prentice Hall of India.
3. Control Systems - ManikDhanesh N, Cengage publications.
4. Control Systems Engineering - S.Palani,TataMcGraw Hill Publications.

e- Resources & other digital material

1. https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ee84/
2. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee25/
3. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee45/

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II Year II Semester

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3	0	0	3

POWER SYSTEMS-1

PRE-REQUISITES: 1) Basic Circuit Analysis

Course objectives: The student should be able to

1. study the principle of operation of hydro and thermal power stations.
2. study the principle of operation of nuclear, gas, diesel power stations and non-conventional energy sources.
3. compute transmission line parameters and understand the concepts of GMD/GMR.
4. know the working of substation equipment and to calculate voltage and power loss in distribution systems.
5. study different types of load curves and tariffs applicable to consumers.

Unit-1 Hydel and Thermal Power Plants

Hydro Electric Power Station: Principle of operation, Schematic arrangement & its components, Selection of site, Advantages and Disadvantages. **(05 hrs)**

Thermal Power Station (Steam): Principle of operation, Schematic arrangement & its components, Selection of site, Efficiency, Advantages and Disadvantages. **(06 hrs)**

Unit-2 Nuclear, Gas, Diesel Power Plants and Non-conventional Energy Sources

Nuclear Power Station: Principle of operation, Schematic arrangement & its components, Selection of site, working of BWR, PWR, FBR. **(07 hrs)**

Gas and Diesel Power Stations: Principle of operation and Equipment (Block diagram approach only). **(02 hrs)**

Non-conventional Energy Sources: Working principle of solar, wind, geo thermal and tidal power stations (Elementary treatment only). **(04 hrs)**

Unit-3 Transmission Line Parameters

Types of conductors, calculation of resistance, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, transposition, bundled conductors, concept of GMD and GMR, effect of earth on capacitance, skin and proximity effects, Numerical Problems. **(12 hrs)**

Unit-4 Substations and Distribution Systems

Substations: Classification, Equipment and its location, Layout of 33/11 kV substation. **(06 hrs)**

Distribution Systems: Classification, Design features, Voltage drop and power loss calculations, Comparison between DC and AC distribution systems, Numerical Problems. **(06 hrs)**

Unit-5 Economics aspects of Power Generation and Tariff

Economic aspects of Power Generation: Load curve, load duration, integrated load duration curves and mass curve, connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor, plant use factor, utilization factor, base and peak load plants, Numerical problems. **(06 hrs)**

Tariff: Costs of generation and its division, objectives, characteristics, classification, Numerical problems. **(06 hrs)**

Course Outcomes

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

CO1 **Understand** the working of hydro and thermal power plants **{Understand level, KL2}**

CO2 **Explain** the working of nuclear, gas, diesel power plants and non-conventional energy sources. **{Apply level, KL3}**

CO3 **Analyze** transmission lines parameters **{Analyze level, KL4}**

CO4 **Evaluate** the performance of AC and DC distribution systems. **{Evaluate level, KL5}**

CO5 **Analyze** the different load curves and tariff methods. **{Apply level, KL4}**

Text books:

1. A text book on Power System Engineering by M.L. Soni, P.V.Gupta, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co Pvt. Ltd.
2. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhawa, New Age International Private Limited.

Reference books

1. Electrical power systems by C.L.Wadhwa, New Age International (P) Ltd, Publishers, 1998.
2. Electrical Power Distribution Systems by V. Kamaraju, TMH.
3. Elements of Electrical Power Station Design by M.V. Deshpande, PHI.
4. Modern Power System Analysis by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2ndEdition

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/102/108102047/
2. https://www.coursera.org/learn/electric-power-systems
3. https://www.classcentral.com/course/electric-power-systems-12053#
4. https://pdhonline.com/courses/e104a/e104a_new.htm
5. https://emp.lbl.gov/sites/all/files/advanced-transmission-technologies.pdf
6. https://www.hitachi.com/rev/pdf/2002/r2002_04_106.pdf
7. http://regulationbodyofknowledge.org/wp-content/uploads/2013/03/NERA_Electricity_Tariff_Structure.pdf

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II Year II Semester

L	T	P	C
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DIGITAL ELECTRONICS

Pre-Requisites : Nil

Course objectives: The student should be able to

1. To understand common forms of number representation in digital circuits and Boolean algebra.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems and simplify logic expressions using basic theorems, K-map and Tabular methods.
3. To understand the concept of Combinational logic design and realize logic expressions using MUX and Decoder
4. Illustrate the concept of sequential logic design; analyze the operation of flip-flop and conversion from one flip-flop to another, and application of flip-flop.
5. To impart to student the concepts of sequential machines of digital system.

Unit-1 Number Systems and Boolean Algebra **14 Hours**

Number systems: Introduction to different number system and their conversions, Complement of number system and subtraction using complement method, Floating-Point Representation, Weighted and Non-weighted codes and its Properties, Error detection and correction codes,

Boolean Algebra: Boolean algebra and logic gates, Basic theorems and properties of Boolean Algebra, Boolean functions, canonical and standard forms, Universal Gates.

Unit-2 Minimization Methods of Boolean functions **11 Hours**

Minimization of logic expressions by algebraic method, Sum of Products (SOP), Product of Sums (POS), K-Map Method, Don't Care Combinations, Multilevel NAND/NOR realizations, Prime and essential Prime Implicants, Tabular Method, Prime Implicants Chart, Simplification Rules.

Unit-3 Combinational Circuits **14 Hours**

Design procedure, Half/full adders, Half / full substractors, Carry look ahead adder, BCD adder, Multiplexer/De-Multiplexer, Encoder/Decoder, Priority encoders, Implementation of Higher-Order Device Using Lower Order devices, Implementation of combinational logic using MUX/Decoder, Magnitude Comparator, Programmable logic devices.

Unit-4 Sequential Circuits **12 Hours**

Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

Registers and Counters: Shift Registers Left, Right and Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

Unit-5 Sequential Machines **8 Hours**

Finite State Machines, Synthesis of Synchronous Sequential Circuits, Mealy and Moore models, Serial Binary Adder, Sequence Detector, Parity-bit Generator Synchronous Modulo N – Counters, Finite state machine capabilities and limitations.

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

CO1: Distinguish the analog and digital systems, apply positional notations, number systems,

computer codes in digital systems. **(Remember, Understand, and Apply)**
CO2: Uunderstand the Boolean Algebra theorems, simplify and design logic circuits. **(Understand, Apply, Analyze and valuate)**
CO3: Implement combinational logic circuit design and modular combinational circuits using encoders, decoders, multiplexers and demultiplexers. (**Apply, Analyze, valuate, and create)**
CO4: Understand the basic elements of sequential logic circuits. **(Understand, Apply, Analyze)**
CO5: Design and analyze sequential circuits. **(Apply, Analyze and create)**

Text books:

1. Digital Design by Mano, PHI
2. Modern Digital Electronics by RP Jain, TMH
3. Switching Theory and Logic Design by A. Anand Kumar, PHI.
4. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, Cambridge.

Reference books:

1. Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMH edition
2. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers

e- Resources & other digital material:

1. https://nptel.ac.in/courses/117/106/117106086/
2. https://nptel.ac.in/courses/108/105/108105113/
3. https://www.coursera.org/learn/digital-systems
4. https://swayam.gov.in/nd1_noc20_ee70/preview

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II Year II Semester

L	T	P	C
2	1	0	3

THERMAL AND HYDRO PRIME MOVERS

Prerequisites: Engineering Mathematics, Engineering Physics, Engineering Thermodynamics

Course Objectives: The student should be able to

1. Identify the unique vocabulary associated with thermodynamics through the precise definition of basic concepts and also apply the laws of thermodynamics to cycles, cyclic devices.
2. Familiarize with the various I.C. Engine systems along with their function and necessity, also performance analysis of I.C. Engines and Gas turbine Power plants.
3. Provide the basic knowledge of components being used in steam power plant cycles and to analyze the energy transfers and transformations in steam turbine.
4. Describe briefly the concepts of different fluid properties, present numerous examples related to variation of pressure in a fluid and measurement of pressure and flow rate.
5. Illustrate briefly impact of jets, hydraulic pumps and also evaluate the performance of hydraulic turbines.

Unit-1 BASIC CONCEPTS OF THERMODYNAMICS: Thermodynamic System, Surrounding, Boundary, Universe, Control Volume, Control Surface, Classes of Systems, State, Thermodynamic Properties, Process and Cycles, Thermodynamic Equilibrium, Reversibility, Quasi static Process.

ZEROTH LAW OF THERMODYNAMICS: Equality of temperature.

FIRST OF THERMODYNAMICS: Statement, Internal energy, Flow work, The Steady Flow Process-Steady Flow Energy Equation, simple Problems.

SECOND LAW OF THERMODYNAMICS: Kelvin-Planck & Clausius Statements of Second law of Thermodynamics, Differences between reversible and Irreversible Process, Carnot Cycle and its specialties.

Unit-2 AIR STANDARD CYCLES: Otto, Diesel and Dual cycles, its comparisons, Brayton Cycle.

I. C. ENGINES : Classification, Working principles, Valve and Port Timing Diagrams, Engine systems- fuel injection, carburetion, ignition, cooling and lubrication – Parameters of performance, Determination of Frictional Power & Indicated Power, Engine performance evaluation.

GAS TURBINES: Simple gas turbine plant, Classification, Analysis of closed and open cycle plants, Applications, Performance parameters, Basic Problems.

Unit-3 STEAM TURBINES: Working Principle, Classification, Simple Impulse Turbine, Vector diagrams of velocities, Combined Velocity diagram, Work done on the blade, Axial Thrust, Blade efficiency, stage efficiency, overall efficiency, Effect of blade friction on velocity diagram, simple problems on Impulse turbine, Compounding of Impulse Turbine, Reaction Turbine, Velocity Diagram for Reaction Turbine, Degree of Reaction (only theory Part on reaction Turbines).

Unit-4 FUNDAMENTALS OF FLUID MECHANICS: Definition of fluid, differences between a solid and fluid, physical properties of fluids- Density, Specific Weight, Specific gravity, viscosity, Types of Fluids and Fluid flows, Continuity and Bernoulli's equations.

MEASUREMENT OF PRESSURE AND FLOW: Pascal's law for pressure at a point, pressure variation in a fluid at rest, Absolute, gauge, Atmospheric and vacuum pressures.

Unit-5 IMPACT OF JETS: Impulse momentum equation, Impact of Jet on stationary and moving vanes (flat and curved).

HYDRAULIC TURBINES: Essential elements of a hydroelectric power plant, head and efficiencies of hydraulic turbines, Classification of turbines, Working principle, Efficiency

calculation and Design principles for Pelton Wheel, Francis and for Kaplan turbines.

PUMPS: Types of pumps, main components and working principle of centrifugal and reciprocating type pumps (theory part only), Submersible pump working.

Course Outcomes

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

CO1 Explain the fundamental concepts of Thermodynamics and also **apply** the laws of thermodynamics to cycles, cyclic devices. **{Apply level, KL3}**

CO2 Understand about the working of IC engines and gas turbine plants including its performance **evaluation. {Apply level, KL3}**

CO3 Analyze the energy transfers and transformations while steam is flowing through the blades of steam turbine. **{Analyze level, KL4}**

CO4 Understand about fluid properties and also **apply** the Bernoulli's theorem for flowing fluids. **{Apply level, KL3}**

CO5 Compute the performance of hydraulic turbines and also **understand** working of the hydraulic pumps. **{Apply level, KL3}**

Text books:

1. Thermal Engineering by Mahesh Rathore, McGraw- Hill,2010
2. Hydraulics and Fluid mechanics including Hydraulic machinery by MODI and SETH, Standard Book House Publications,2019.

Reference books

1. I.C. Engines by V. Ganesan, McGraw- Hill,4th edition.
2. Thermal Engineering by RK Rajput, Lakshmi Publications,2010.
3. Fluid Mechanics and Hydraulic Machines by R.K.Rajput, Lakshmi Publications, Sixth Edition
4. "Fluid Mechanics" by Victor. L. Streeter & E.Benjamin Wylie, McGraw- Hill, Indian edition.

e- Resources & other digital material

1. https://nptel.ac.in/courses/112/105/112105171/
2. https://nptel.ac.in/courses/112/105/112105183/
3. https://nptel.ac.in/courses/105/101/105101082/
4. https://nptel.ac.in/courses/105/103/105103095/
5. http://nptel.ac.in/courses/112105123/
6. http://nptel.ac.in/courses/112108148/

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II Year II Semester

L	T	P	C
0	0	3	1.5

CONTROL SYSTEMS LAB

Learning Objectives:

- To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors and Synchros.
- To understand time and frequency responses of control system with and without controllers and compensators.

Any 10 of the following experiments are to be conducted:

1. Time response of Second order system
2. Characteristics of Synchros
3. Effect of P, PD, PI, PID Controller on a second order systems
4. Study of characteristics of Lag and lead compensators – Magnitude and phase plot
5. Obtaining the Transfer function of DC motor
6. Bode Plot, Root locus, Nyquist Plots for the transfer functions of systems up to 5^{th} order using Simulation software.
7. Controllability and Observability Test using Simulation software.
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Characteristics of DC servo motor
12. Block Diagram Representation of Field Controlled DC servo Motor Using Simulink.

Course Outcomes:

After the completion of the course the student should be:

CO1: Able to analyze the time response of a second order system.

CO2: Able to analyze the effect ofP, PI,PD, PID controllers and Lag, Lead compensators.

CO3:Analyze the performance and working of magnetic amplifier, DC, AC servomotors and synchros.

CO4: Able to judge the stability in time and frequency domain.

CO5: Able to test the controllability and observability.

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II Year II Semester

L	T	P	C
0	0	3	1.5

ELECTRICAL MACHINES-1 LAB

Course Objectives:

1. To plot the magnetizing characteristics and understand the load characteristics of DC shunt generator.
2. Learn the methods of speed control of DC shunt motors.
3. Determine the performance of DC machines by direct and indirect loading methods.
4. Predetermine the efficiency and regulation of single-phase transformer and assess their performance.
5. Study the conversion of three phase to two-phase by Scott connection.

LIST OF EXPERIMENTS

Any 10 of the following experiments are to be conducted:

1. Magnetization characteristics of DC shunt generator-critical Resistance and critical speed.
2. Load test on DC shunt generator.
3. Load test on DC series generator.
4. Load test on DC Compound generator.
5. Brake test on DC Shunt motor.
6. Brake test on DC compound motor.
7. Hopkinson's test on DC shunt machines. Predetermination of efficiency.
8. Swinburne's test on DC shunt motor.
9. Speed control of DC shunt motor.
10. OC& SC test on single phase transformer.
11. Sumpner's test on single phase transformers.
12. Scott connection of transformers
13. Separation of core losses of a single-phase transformer.

Course Outcomes:

Students able to

CO1: Analyze the characteristics and performance of DC generator.

CO2: Investigate the speed control and testing methods of DC motors.

CO3: Determine the performance of DC machines by direct and indirect loading methods.

CO4: Perform various types of tests on transformers for assessing losses.

CO5: Achieve three-phase to two phase transformation.

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II Year II Semester

L	T	P	C
0	0	3	1.5

THERMAL AND HYDRO PRIME MOVERS LAB

Prerequisite: -Nil-

COURSE OBJECTIVE: To impart practical knowledge on the performance evaluation methods of various internal combustion engines, flow measuring equipment and hydraulic turbines and pumps.

Note: To Conduct A Minimum Of 10 Experiments By Conducting A Minimum Of Five From Each Section.

LIST OF EXPERIMENTS:

SECTION A - THERMAL ENGINEERING LAB

1. I.C. Engines valve / port timing diagrams.
2. I.C. Engines performance test on 4 -stroke Diesel engine.
3. I.C. Engines performance test on 2-stroke petrol engine.
4. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine
5. Determination of FHP by retardation and motoring test on IC engine.
6. I.C. Engines heat balance on petrol / Diesel engines.
7. Study of boilers.

SECTION B – HYDRAULIC MACHINES LAB

1. Calibration of Venturimeter.
2. Calibration of Orifice meter.
3. Impact of jets on Vanes.
4. Performance Test on Pelton Wheel.
5. Performance Test on Francis Turbine.
6. Performance Test on Centrifugal Pump.
7. Performance Test on Reciprocating Pump.

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

CO1: Compute the performance of the IC Engines for a given conditions and also draw the valve and port timing diagrams. **(Apply Level)**

CO2: Determine the frictional power by using the Morse test, retardation test and motoring test. **(Apply Level)**

CO3: Calibrate discharge measuring devices and **finding** discharge through the venture meter and the orifice meter. **(Apply Level)**

CO4: Analyze the performance of hydraulic machines. **(Analyze Level)**

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II Year II Semester

L	T	P	C
0	0	3	1.5

SOCIAL RELEVANT PROJECT

Course Objectives:

To enable the student

- Acquire the requisite skills and to apply the same to a given problem in the relevant technical area.
- Independently analyze and discuss complex inquiries/problems within the given constraints and handle larger problems at an advanced level within the technical area.
- Reflect on, evaluate, and critically assess one's own results and correlate it with other scientific results.
- Document and present one's own work for a given target group, with strict requirements on structure, format and language usage.
- Identify one's need for updating skills and knowledge and to continuously develop one's own competencies

Syllabus:

A number of social relevant research projects, e.g., in sectors of defense, medicine environment, energy, health, infrastructure, etc.Some representative activities in these areas are briefly mentioned below.

- **Environment**

In the area of environment, the projects like development of a zero discharge toilet, climate models, development of air quality standards which have been accepted by the Govt. of Indiadevelopment of an air quality index for dissemination of information to the people and for policy making etc

- **Energy**

In the area of energy, development of photovoltaics, solar-hydrogen generation, connection of solar cells to the grid in a smart manner, grid stability are some of the activities.

- **Defense**

In the area of defense, the projects like autonomous vehicles and helicopter, unmanned combat aircraft, materials development for defense applications, technologies for remediation of NBC threats and sensors for detecting explosives, activities with the ordinance factories, networking and communication systems.

- **Healthcare**

In the area of healthcare, the projects like helping devices for specially abled people, neurodegenerative disorders, cancer and bone degeneration etc

- **Other**

Few more socially relevant research projects to solve agricultural related projects like Agriculture Knowledge management systems on the cloud, advisory/alert delivery to the farmers over phones, automatic tagging for agriculture documents.

Course Outcomes:

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

CO1: Acquire the requisite skills and to apply the same to a given problem in the relevant technical area.
CO2: Independently analyze and discuss complex inquiries/problems within the given constraints and handle larger problems at an advanced level within the technical area.
CO3: Reflect on, evaluate, and critically assess one's own results and correlate it with other scientific results.
CO4: Document and present one's own work for a given target group, with strict requirements on structure, format and language usage.
CO5: Identify one's need for updating skills and knowledge and to continuously develop one's own competencies

Text Books:

- Any technical paper publications

References:

- https://csie.iitm.ac.in/SocialProjectsIITM.html

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III Year I Semester

L	T	P	C
2	1	0	3

POWER SYSTEMS-II

PRE-REQUISITES: 1) Basic Circuit Analysis, Power Systems-I

Course objectives: The student should be able to

1. Study the short, medium and long length transmission lines, their models and performance.
2. Study the effect of travelling waves on transmission lines.
3. Study the factors affecting the performance of transmission lines and power factor improvement methods.
4. Discuss sag and tension computation of transmission lines as well as to study the performance of overhead insulators.
5. discuss computation of Z_{bus} and Y_{bus} of power system

Unit-1 Performance of Transmission Lines (15 hrs)

Classification of Transmission Lines – Short, medium, long line and their model representations – Nominal-T–Nominal-Pie and A, B, C, D Constants for symmetrical and Asymmetrical Networks– Numerical Problems– Mathematical Solutions to estimate regulation and efficiency of all types of lines – Numerical Problems. **(10hrs)**

Performance of Long Transmission Lines–Rigorous Solution – Evaluation of A,B,C,D Constants– Interpretation of the Long Line Equations, regulation and efficiency– Representation of Long Lines – Equivalent-T and Equivalent Pie network models (Numerical Problems). **(5hrs)**

Unit-2 Travelling waves and Power Systems transients (15 hrs)

Travelling waves

Incident, Reflected and Refracted Waves –Surge Impedance and SIL of Long Lines–Wave Length and Velocity of Propagation of Waves. (8hrs)

Power system Transients

Types of System Transients – Travelling or Propagation of Surges – Attenuation–Distortion– Reflection and Refraction Coefficients – Termination of lines with different types of conditions – Open Circuited Line–Short Circuited Line – T-Junction– Lumped Reactive Junctions.(7hrs)

Unit-3 Various Factors governing the Performance of Transmission line (12hrs)

Skin and Proximity effects – Description and effect on Resistance of Solid Conductors – Ferranti effect – Charging Current –Shunt Compensation –Corona – Description of the phenomenon–Factors affecting corona–Critical voltages and power loss – Radio Interference.

Unit-4 Sag and Tension Calculations and Overhead Line Insulators (12hrs)

Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice on weight of Conductor–Numerical Problems – Stringing chart and sag template and its applications– Types of Insulators – String efficiency and Methods for improvement– Numerical Problems – Voltage distribution–Calculation of string efficiency–Capacitance grading and Static Shielding.

Unit-5 Bus Admittance Matrix & Bus Impedance Matrix (12hrs)

Bus Admittance Matrix (Ybus):

Per Unit quantities, Single line diagram, Impedance diagram of a power system, Primitive network representation, Formation of Ybus matrix by direct inspection method. Numerical Problems. (6hrs)

Bus Impedance Matrix (Zbus):

Formation of Zbus matrix by building algorithm, Modification of Zbus for the changes in

network, Numerical Problems (3 bus system only). (6hrs)

Course Outcomes

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

CO1 **Evaluate** the performance of transmission lines. **{Evaluate level, KL5}**

CO2 **Understand** the Power systems transients, travelling waves **{Understand level, KL2}**

CO3 **Evaluate** the various factors governing the performance of transmission line. **{Evaluate level, KL5}**

CO4 **Analyze** the sag and tension calculations and overhead line insulators. **{Apply level, KL4}**

CO5 **Evaluate** the bus admittance matrix & bus impedance matrix. **{Evaluate level, KL5}**

Text books:

1. Electrical power systems by C.L.Wadhwa, New Age International (P) Ltd, Publishers, 1998.
2. Modern Power System Analysis, I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2nd Edition
3. A Text Book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar A.Chakrabarthy, DhanpatRai& Co Pvt. Ltd.

Reference books:

1. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4thedition
2. Modern Power System Analysis by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2nd Edition

III Year I Semester

L	T	P	C
3	0	0	3

SPECIAL ELECTRICAL MACHINES

PRE-REQUISITES:1) Electrical Machines-I &II

Course objectives: The student should be able to

1. To explain theory of different permanent magnetic material and applications.
2. To explain the performance and control of stepper motors, and their applications.
3. To describe the operation and characteristics of switched reluctance motor.
4. To explain the operation permanent magnet brushless square wave and sine wave motors
5. To explain the theory of travelling magnetic field and applications of linear motors

Unit-1 Permanent magnet materials and PMDC motors(15hrs)

Introduction-classification of permanent magnet materials used in electrical machines-minor hysteresis loop and recoil line-Stator frames of conventional dc machines-Development of electronically commutated dc motor from conventional dc motor.

(07hrs

Permanent-magnet materials and characteristics-B-H loop and demagnetization characteristics-Temperature effects: high temperature effects-reversible losses Irreversible losses -Application of permanent magnets in motors-power density-operating temperature range-severity of operation duty. **(08hrs)**

Unit-2 Stepper Motors (14 hrs)

Classification of stepper motors – Hybrid and Variable Reluctance Motor (VRM) - Construction and principle of hybrid type synchronous stepper motor – Different configuration for switching the phase windings control circuits for stepper motors – Open loop and closed loop control of 2-phase hybrid stepping motor. **(08hrs)**

Construction and principle of operation of Variable Reluctance Motor (VRM) – Single stack and multiple stack – Open loop control of 3- phase VR Stepper Motor- Applications**(06hrs)**

Unit-3 Switched Reluctance Motors (10hrs)

Construction – Comparison of conventional and switched reluctance motors – Design of stator and rotor pole arcs – Torque producing principle and torque expression

(5 hrs)

Different converter configurations for SRM – Drive and power circuits for SRM – Position sensing of rotor – Applications of SRM**(5 hrs)**

Unit-4 Square and Sine Wave Permanent Magnet Brushless DC Motor (15hrs)

Types of constructions – Surface mounted and interior type permanent magnet – Principle of operation of BLDC motor. Torque and EMF equations – Torque speed characteristics – Performance and efficiency- Square wave brushless motors with 120^0 and 180^0 magnetic areas commutation. **(8 hrs)**

Sine wave Permanent Magnet Brushless Motor Torque and EMF equations –Torque/speed characteristics – Comparison between square wave and sine wave permanent magnet motors - Applications. **(7 hrs)**

Unit-5 Linear Induction Motors (10hrs)

Construction– principle of operation–Double sided LIM from rotating type Induction Motor **(5 hrs)**

Schematic of LIM drive for traction – Development of one sided LIM with back iron equivalent circuit of LIM. **(5 hrs)**

Course Outcomes

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

CO1 To understand theory of different permanent magnetic material and applications.**{Understand level, KL2}**

CO2 To explain the performance and control of stepper motors, and their applications.**{Understand level, KL2}**

CO3 To describe the operation and characteristics of switched reluctance motor **{ Understand level, KL2}**

CO4 To explain the operation permanent magnet brushless square wave and sine wave motors .**{Understand level, KL2}**

CO5 To explain the theory of travelling magnetic field and applications of linear motors . **{Understand level, KL2}**

Text books:

1. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.

2. Special electrical Machines, K.VenkataRatnam, University press, 2009, New Delhi.

Reference books:

1. Special Electrical Machines ,G.Janradhana, PHI Publishers

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/102/108102156/

III Year I Semester

L	T	P	C
2	0	0	2

INTERNET OF THINGS

Pre-Requisites: Fundamentals of computers and its importance

Preamble: "Internet of Things" (IoT) is a very new concept created and developed in recent years. This subject first introduces the concept and origin of IoT, then describes basic principles of IoT, next illustrates the framework of IoT, and finally takes examples to suggest applications of IoT. The subject intends to help students recognize IoT as a whole, to hold the clue and venation of the development of IoT, and to forecast future trends of IoT development.

Course objectives:
The student should be able to

1. study the introductory concepts, design procedures and enabling technologies of IoT
2. Learn the concepts of networking and building blocks of IoT.
3. Study changes in architectures of IoT and its challenges.
4. Know the procedure of IoT Design Methodology.
5. Learn about IoT solutions to different real time problems.

Unit – 1: Introduction to IoT (10 hrs)
Introduction to Internet of Things, Block diagram of IoT , Definition and characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT levels. (Basic concepts only).

Unit-2: IoT & M2M (10 hrs)
Machine to Machine, Difference between IoT & M2M, Software defined Networking, Network function virtualization, IoT Device and its basic building blocks

Unit-3: **Architecture and Challenges in IoT (10 hrs)**
Three, Four, Five and Seven layer, Cloud and Fog based, Social IoT and its representative architecture, Design challenges, Development challenges, Security challenges, Other challenges, Need for IoT systems management.

Unit-4: IoT Platforms Design Methodology (10 hrs)
Introduction, Step by step procedure of IoT Design Methodology, Development of domain and Information model for IoT systems, Example case studies.

Unit-5: Domain Specific IoTs (10 hrs)
Home automation, Smart cities, Environment, Energy, Retail, Logistics, Agricultural, Industry, Health and Lifestyle.

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

CO1 **Understand** the concepts and designing of IoT**{Understand level, KL2}**
CO2 **Explain** the concepts of networking and building blocks of IoT.**{Understand level, KL2}**
CO3 **Analyze** changes in architectures of IoT and its challenges **{Analyze level, KL4}**
CO4 **Explain** the procedure of IoT Design Methodology. **{Understand level, KL2}**
CO5 **Design** IoT solutions to different real time problems. **{Apply level, KL4}**

Text books:

1. **Internet of Things: A Hands-on Approach**, Arshdeep Bahga, Vijay Madisetti, Orient Blackswan Private Limited - New Delhi; First edition, ISBN: 8173719543
2. **The Internet of Things Key Applications and Protocols**, Olivier Hersent, David Boswarthick, Omar Elloumi, John Wiley & Sons Ltd, ISBN: 978-1-119-99435-0
3. **Architecting the Internet of Things**, Dieter Uckelmann, Mark Harrison, Florian Michahelles, Springer Heidelberg Dordrecht London New York, ISBN: 978-3-642-19156-5
4. **Fundamentals of Wireless Sensor Networks: Theory and Practice**, Waltenegus Dargie, Christian Poellabauer, John Wiley & Sons Ltd, ISBN: 978-0-470-97568-8

Reference books:

1. **Networks, Crowds, and Markets: Reasoning About a Highly Connected World**, David Easley, Jon Kleinberg, Cambridge University Press
2. **Rethinking the Internet of Things: A Scalable Approach to Connecting Everything**, daCosta Francis, Henderson Byron, Apress Publications, ISBN: 978-1-4302-5740-0CO4
3. **Getting Started with the Internet of Things**, CunoPfister, OReilly Media, ISBN: 97CO58-1- 4493-9357-1

III Year I Semester

L	T	P	C
2	0	0	2

ELECTRICAL MACHINES MODELLING AND ANALYSIS

PRE-REQUISITES: 1) Electrical Machines-I
2) Electrical Machines-II

Course objectives: The student should be able to

1. Study the Establish unified theory of rotating machines.
2. Understand the concept of phase transformation.
3. Analyze different electrical machines for improved performance through modification of their characteristics.
4. Study develop concepts on mathematical modeling of electrical machines

Unit-1 Basic concepts of Modeling (10 hrs)

Basic Two-pole Machine representation of Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine-voltage, current and Torque equations.

Unit-2 DC Machine Modeling (12 hrs)

Mathematical model of separately excited D.C motor-Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor- Mathematical model of D.C Series motor, Shunt motor-Linearization Techniques for small perturbations.

Unit-3 Reference frame theory & Modeling of single phase Induction Machines (12 hrs)

Linear transformation-Phase transformation - three phase to two phase transformation (abc to dq0) and two phase to three phase transformation dq0 to abc -Power equivalence Mathematical modeling of single phase induction machines.

Unit-4 Modeling of three phase Induction Machine (13 hrs)

Generalized model inarbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model

Unit-5 Modeling of Synchronous Machines and Special Machines(13 hrs)

Modeling of Synchronous Machine: Synchronous machine inductances–voltage equations in the rotor's dq0 reference frame electromagnetic torque-current in terms of flux linkages-three synchronous machine model. **(7 hrs)**

Modeling of Special Machines: Modeling of PM Synchronous motor, modeling of BLDC motor, modeling of Switched Reluctance motor. **(6 hrs)**

Content Beyond the syllabus:

DC Machine Modeling: Steady State analysis-Transient State analysis

Modeling of three phase Induction Machine: state space model with flux linkages as variables.

Course Outcomes

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

CO1 **Develop** modeling of dc machine **{Understand level, KL2}**

CO2 **Apply** mathematical modeling concepts to 3-phase Induction machines **{Apply level,**

KL3}

CO3 **Evaluate** the control strategies based on dynamic modeling of 3-ph Induction machines **{ Evaluate level, KL5}**

CO4 **Evaluate** the control strategies based on dynamic modeling of 3-phase synchronous machine. **{Evaluate level, KL5}**

CO5 **Analyze** the BLDC Machine and switched reluctance machine based on mathematical modeling of BLDCM and SRM. **{Apply level, KL4}**

Text books:

3. Generalized theory of Electrical Machinery –P.S.Bimbra- Khanna Publishers.
4. Electric Motor Drives - Modeling, Analysis& control -R.Krishnan- Pearson Publications1st edition -2002.

Reference books:

1. Analysis of Electrical Machinery and Drive systems – P.C.Krause, OlegWasynczuk, Scott D.Sudhoff – Second Edition-IEEE Press.
2. Dynamic simulation of Electric machinery using Matlab / Simulink –CheeMunOng-PHl.
3. Modern Power Electronics and AC Drives-B.K. Bose - PHI

e- Resources & other digital material

http://nptel.iitm.ac.in

III Year I Semester

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2	0	0	2

MICRO ELECTRO MECHANICAL SYSTEMS

PRE-REQUISITES: --

Course objectives: The student should be able to

1. To understand the standard micro fabrication techniques and working principles of mechanical sensors and actuators
2. To understand the fundamental principles of thermal sensors and actuators
3. To learn the fundamental principles of magnetic sensors and actuators and optic applications in MEMS
4. To understand Applications of RF MEMS and micro fluid actuation methods
5. To teach applications MEMS in chemical and biological systems.

Unit-1 INTRODUCTION Definition of Mems, mems history and development, micro machining, lithography principles &methods, structural and sacrificial materials. Thin film deposition, impurity doping, etching, surface micro machining, wafer bonding .LIGA

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitative, piezo electric, strain, pressure flow, pressure measurement by micro phone ,MEMS gyroscopes ,shear mode piezo actuator ,gripping piezo actuator ,inchworm technology

Unit-2 THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe ,peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors. mems thermo vessels, pyro electricity, shape memory alloys (SMA),U-shaped horizontal and vertical electro thermal actuator ,thermally activated mems relay micro spring thermal actuator data storage cantilever .

Unit-3 MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for mems and properties, magnetic sensing and detection,magneto resistive sensor, more on hall effect ,magneto diodes ,magneto transistor ,mems magnetic sensor ,pressure sensor utilizing moke mag mems actuators by directional micro actuator feedback circuit integrated magnetic actuator ,large force reluctance actuator ,magnetic probe based storage device .

MICRO-OPTO –ELECTRO MECHANICAL SYSTEMS:MOEMS technology ,properties of light ,light modulators ,beam splitter ,micro lens ,micro mirrors, digital micro mirror device(DMD),light detectors ,grating light valve (GLV),optical switch .wave guide and tuning shear stress measurement

Unit-4 RADIO FREQUENCY (RF) MEMS: RF-based communication systems .RF MEMS, Mems inductors, varactors, tuner/filter resonator clarification of tuner, filter resonator, mems switches, phase shifter.

MICROFLUIDIC SYSTEMS: Applications considerations on micro scale fluid, fluid actuation methods, dielectrophoresis (DEP),electro wetting ,electro thermal flow, thermo capillary effect electro osmosis flow, opto electro wetting (OEW),tuning using micro fluidics ,typical micro fluidic channel ,micro fluid dispenser, micro needle, molecular gate ,micro pumps

Unit-5 CHEMICAL AND BIO MEDICAL MICRO SYSTEMS: Sensing mechanism &principle membrane transducer materials ,chem. Lab on chip (CLOC), chemo resisters ,chemo capacitors ,chemo transistors, electronic nose(E nose),mass sensitive chemo sensors, fluroscence detection ,calorimetric spectroscopy

Course Outcomes

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

CO1 To understand the applications of micro-fabrication processes in MEMS and working principles of Mechanical sensors and actuators **(KL-2)**

CO2 To Explain the various working principles of Thermal sensors and actuators in MEMS. **(KL-2)**

CO3 To Learn working principles of Magnetic sensors, actuators and various principles Light and its applications in MEMS. **(KL-2)**

CO4 To Learn and apply the principles of RF and to understand multi domain problems of MEMS in micro-fluidic systems **(KL-2)**

CO5 An ability to learn knowledge of MEMS in Chemical and Bio Medical Micro Systems **(KL-2)**

Text books:

1. MEMS, Nitaigour Premchand Mahalik,TMH Publishing co.

Reference books:

1. Foundation of MEMS .Chang Liu .Prentice Hall Ltd.
2. Introductory MEMS, Thomas M Adams, Richard A Layton, Springer International Publishers.
3. MEMS design and fabrication by Mohamed gad -el -hak CRC
4. MEMS and NEMS, Sergey EdwrdLyshevski, CRC Press, Indian Edition.
5. Mems and Micro systems: Design and manufacture .Tai-ran Hsu.TMH Publishers
6. BIO-Mems (Micro Systems) Gerald Urban, Springer.

e- Resources & other digital material:

1. http://www.csa.com/discoveryguides/mems/gloss_f.php
2. https://www.mems-exchange.org/MEMS/applications.html

III Year I Semester

L	T	P	C
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POWER ELECTRONICS

PRE-REQUISITES: 1) Basic Circuit Analysis 2) Basics of Electronics

Preamble: It is very common to use power converters in all the systems of engineering. So it is compulsory for the students to imbibe the concepts of power electronics. This course covers characteristics of semiconductor devices, ac/dc, dc/dc, ac/ac and dc/ac converters.

Course objectives: The main objectives are

1. To study the characteristics of various power semiconductor devices and to design firing circuits for SCR.
2. To understand the operation of single phase full–wave converters and analyze harmonics in the input current.
3. To study the operation of three phase full–wave converters.
4. To understand the operation of choppers and AC-AC converters.
5. To understand the operation of inverters and application of PWM techniques for voltage control and harmonic mitigation.

Unit-1 Power Semi-Conductor Devices (11 hrs)

static Characteristics of power MOSFET and power IGBT

Silicon controlled rectifier (SCR): Basic theory of operation of SCR–Static characteristics–Dynamic characteristics of SCR - Turn on and turn off methods– Firing circuits of SCR-Snubber circuit design, Single phase diode bridge rectifier.

Unit-2 Single-Phase AC-DC Converters (13 hrs)

Half wave controlled converter, Full wave controlled converters: Half controlled bridge converter with R and RL loads–continuous and discontinuous conduction, Fully controlled bridge converter with R and RL loads–continuous and discontinuous conduction, Effect of source inductance in fully controlled bridge rectifier with continuous conduction.

Unit-3 Three-Phase AC-DC Converters (12 hrs)

Three-phase Half controlled bridge converter with R and RL loads: continuous and discontinuous conduction, Three-phase Fully controlled bridge converter with R and RL loads: continuous and discontinuous conduction, Three-phase Dual converter.

Unit-4 DC–DC Converters (12 hrs)

Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode only. (05 hrs)

AC – AC Regulators.

Integral cycle control, Single phase-controlled AC voltage controller with R and RL loads , Single phase bridge Cycloconverters with R-load only. (07 hrs)

Unit-5 DC–AC Converters (12 hrs)

1- phase full bridge inverters with R and RL loads, Unipolar and Bipolar switching, 3-phase inverters: 120^0 and 180^0 conduction modes, Sinusoidal pulse width modulation method, Current Source Inverter (CSI)

Course Outcomes

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

CO1 **Design** firing circuits for SCR. **{Apply level, KL4}**

CO2 **Evaluate** the performance of converters and can suggest the converter required for DC drives. **{Evaluate level, KL5}**

CO3 **Analyze** the source current harmonics. **{Analyze level, KL4}**

CO4 **Understand** the operation of different types of DC-DC converters**{Understand level, KL2}**

CO5 **Explain** the operation of inverters and application of PWM techniques for voltage control and harmonic mitigation. **{Explain level, KL3}**

Text books:

1. "Power Electronics" M.D.Singh,K B Khanchandani,2nd edition, Tata Mc-Graw Hill publishers,2007.
2. "Power Electronics" P.S.Bhimbra, 3rd edition, Khanna Publishers, 2002.
3. "Power Electronics" Daniel W.Hart, 1st edition, Tata Mc-Graw Hill publishers,2011.

Reference books:

1. "Power Electronics: Circuits, Devices and Applications" M.Harnur Rashid,3rd edition, Pearson,2009.
2. "Power Electronics: converters, applications & design" Ned Mohan, Tore M. Undeland, W.P. Riobbins3rdedition,Wiley India Pvt. Ltd,2009.
3. "Thyristorised Power Controllers" G. K. Dubey,S.R.Doradla,A.Joshi, R. M. K.Sinha,1st edition, New Age International (P) Limited Publishers, 1996

e- Resources & other digital material

2. https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-ee01/
3. https://www.coursera.org/learn/power-electronics
4. https://www.classcentral.com/course/powerelectronics-716
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007/lecture-notes/

III Year I Semester

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3	0	0	3

UTILIZATION OF ELECTRICAL ENERGY

Pre-Requisites: Electrical Circuit Analysis, Power Systems,

Preamble: The objective of the course is to provide the first detailed treatment of fundamental understanding and application of electrical energy in power systems. Beginning with the basic terms, concepts and power system components representations, the course will present power generation technologies and power delivery systems.

Course objectives:

The main objectives are

1. To describe the concepts of electricity applications in heating and welding procedures
2. To explain the terminology of illumination engineering and its applications.
3. To gain the knowledge about electric traction systems and its performance parameters.
4. To describe the analytical concepts of electric traction systems with reference to braking, power and energy calculations.
5. To teach the theory about different electrical appliances and electric vehicles.

Unit-1 Electric Heating & Welding (14hrs)

Electric Heating (07 hrs)

Advantages and methods of electric heating–Resistance heating, induction heating and dielectric heating – Arc furnaces – Direct and indirect arc furnaces

Electric Welding (07 hrs)

Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding

Unit-2 Illumination(15 hrs)

Illumination fundamentals (05 hrs)

Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

Illumination concepts (10 hrs)

Discharge lamps, MV and SV lamps, comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting, LED lighting, Street and flood lighting.

Unit-3 Electric Traction-1(13 hrs)

Electric Traction Speed - Time Curves and Mechanics of Train Movement (07 hrs)

Introduction, Systems of Traction, Systems of electric Traction, Speed-Time Curves for Train Movement, Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion, Load equalization.

Motors for Electric traction(06 hrs)

Introduction, Series and Shunt Motors for Traction Services, Two Series Motors are used to drive a Motor Car, AC Series Motor, Three Phase Induction Motor, Temperature rise calculations, Calculation of Tractive Effort, Horse Power and Specific Energy consumption for a given run.

Unit-4 Electric Traction-2(13 hrs)

Braking (06 hrs)

Introduction, Regenerative Braking of Three Phase Induction Motors, Braking of Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro–Mechanical Drum Brakes.

Electric Traction Systems and Power Supply (07 hrs)

AC Electrification, Sub-Stations, Feeding and Distribution System for AC and DC Traction systems, Electrolysis by Current through Earth, Negative Booster, System of Current Collection, Trolley Wires.

Unit-5 Applications(13 hrs)

Domestic electrical appliances: Calculation of energy consumption and efficiency of
i. Electric iron. ii. Electric toaster. iii. Electric water heater. iv. Microwave oven. v. Fans (Ceiling and Table fan) vi. Washing Machine. vii. Grinder/ Mixer/ juicer. viii. Vacuum Cleaner. ix. Flour Mill. x. Air conditioner, Concept of Star System for energy conservation.**(07 hrs)**

Electric Vehicles:(06 hrs)

Introduction, Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving vehicles, Energy Consumption calculations.

Content Beyond the syllabus:(Not considered for evaluation)

Electric Elevator machines and their motors, Electrolytic processes, Electric circuits used in Refrigeration, Air Conditioning and Water coolers, LCD displays, Electromechanical processes.

Course Outcomes:

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

CO1 **Describe** about electric heating and welding procedures

CO2 **Articulate** the terminology of illumination, **Explain** the working of electric lamps and design of lightning schemes

CO3 **Discuss** systems of electric traction, speed-time curves and mechanics of movement.

CO4 **Explain** about braking methods used in traction systems and **calculate** different performance parameters of traction

CO5 **Examine** different real time electrical appliances and applications in electric vehicles

Text books:

1. **"Utilization of Electrical Energy",** V V L Rao, Universities Press, 1981.
2. **"Art & Science of Utilization of Electrical Energy"**, H. Partab, 2nd edition, DhanpatRai& Sons, 2017.
3. **"A Text book on Power System Engineering"**, M.L. Soni, P.V. Gupta, U.S. Bhatnagar and A. Chakrabarti, DhanpatRai Publishing Company (P) Limited, 2016.
4. **"Modern Electric,Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design"**, MehrdadEhsani, YiminGao, Sebastien E Gay, Ali Emadi, 1st edition, CRC Press, 2004.

Reference books:

1. **"Utilization of Electrical Power including Electric drives and Electric traction",** N.V. Suryanarayana, 2nd edition, New Age Publishers, 2017.
2. **"Generation, Distribution and Utilization of Electric Energy"**, C.L.Wadhawa, 3rd edition, New Age International Private Limited, 2015.
3. **"Utilization, Generation and Conservation of Electrical Energy",** Sunil S Rao,1st edition, Khanna Publishers, 2000.
4. **"Utilization of Electric Power and Electric Traction",** G.C. Garg, 1st edition, Khanna Publishers, 2018.

e-resources & other digital material

1. https://nptel.ac.in/courses/108/105/108105060/
2. https://www.governmentpolytechnicnayagarh.org/upload/ueet(Pm).pdf
3. https://www.coursera.org/learn/electric-utilities

4. https://www.coursera.org/learn/electric-power-systems
5. https://www.coursera.org/lecture/electric-power-systems/distribution-ZujEz
6. https://www.edx.org/learn/electricity
7. http://indianrailways.gov.in/railwayboard/uploads/codesmanual/ACTraction-II-P-I/ACTractionIIPartICh1_data.htm
8. https://en.wikipedia.org/wiki/Traction_substation
9. https://www.engineeringenotes.com/electrical-engineering/electric-traction-electrical-engineering/power-supply-arrangement-for-ac-track-electrification-electricity/37184
10. https://membership.corrosion.com.au/blog/stray-traction-effects-wheres-the-problem/
11. https://encyclopedia2.thefreedictionary.com/Negative+Booster+Transformer
12. https://en.wikipedia.org/wiki/Current_collector
13. https://en.wikipedia.org/wiki/Overhead_line

III Year I Semester

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SIGNALS AND SYSTEMS

PRE-REQUISITES: Engineering Mathematics-1 and 3

Course objectives: The student should be able to

- Describe signals mathematically and understand how to perform mathematical operations on signals and Compute the Fourier series of a set of well-defined signals from first principles.
- Compute the Fourier transform of a set of well-defined signals and understand the Nyquist sampling theorem and the process of reconstructing a continuous-time signal from its samples.
- Perform the process of convolution and correlation between signals and Compute the output of an LTI system given the input and the impulse response through convolution sum and convolution integral.
- Understand Laplace transforms and their properties for analysis of signals and systems.
- Understand Z-transforms and their properties for analysis of signals and systems.

Unit-1 Signals Analysis and Fourier Series

Signal Analysis: Definition Signal (Continuous time and Discrete time), Elementary signals such as Dirac delta, unit step, unit ramp, sinusoidal and exponential. Classification of signals, time operations on signals. Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions. **(09hr)**

Fourier Series: Representation of Fourier series, Dirichlet's conditions, Properties of Fourier Series, Trigonometric Fourier Series and Exponential/Complex Fourier Series, Complex Fourier spectrum. (06hr)

Unit-2 Fourier Transform and Sampling Theorem

Fourier Transform: Deriving Fourier Transform from Fourier series, Fourier Transform convergence condition, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform. (08hr)

Sampling Theorem: Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling. (05hrs)

Unit-3 Signal transmission through Linear Time Invariant(LTI) Systems and Convolution and Correlation

Signal transmission through Linear Time Invariant (LTI) Systems: System definition (continuous and discrete), properties of systems, impulse response, transfer function, LTI system response, Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Causality and Poly-Wiener criterion for physical realizable systems.(07)

Convolution and Correlation: Concept of convolution, convolution in time and frequency domain properties of Fourier Transform, graphical and analytical convolution, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and energy/power spectral density spectrum. Relation between convolution and correlation.(09)

Unit-4 Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence(ROC) for Laplace Transforms, Properties of ROC of Laplace Transform, Properties of Laplace Transform, Relation between LT and Fourier Transform of a signal, Response of LTI system using Laplace Transform, Laplace transform of causal periodic signals, Laplace transform of certain signals using waveform synthesis. (08hrs)

Unit-5 Z-Transforms: Concept of Z- Transform and Inverse Z-Transform, Distinction between Laplace, Fourier and Z -transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Properties of ROC of Z-Transform, Properties of Z-transforms, Inverse Z-transform, Response of LTI system using Z-Transform, Introduction to DTFT, Relationship between ZT and DTFT, Conversion from Laplace transform to Z-transform and vice-versa, Introduction to DTFT, Relationship between ZT and DTFT. **(08hrs)**

Course Outcomes

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

CO1 The student will be able to **understand** various types of signals mathematically and able to **calculate** complex Fourier spectrum. **{Understand level, KL2,Calculate-KL-4}**

CO2 **Analyse** the continuous-time signals and continuous-time systems using Fourier transform and **Apply** sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct the original signal from samples. **{ Analyse level-KL3, Apply Level-KL3}**

CO3 **Define** systems based on their properties and determine the response of LTI system. **Understand** the concept convolution, correlation, energy spectral density and power spectral density. **{Define KL-1, Understand level, KL2}**

CO4 **Compute** Laplace transforms to analyze continuous time signals and systems and understand the concept of region of convergence.**{ Compute level, KL4}**

CO5 **Compute** Z-transform to analyze discrete-time signals and systems, and understand the concept of region of convergence. **{ Compute level, KL4}**

Text books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications,2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H.Nawab, PHI, 2nd Edn.
3. Signals & Systems- Narayan Iyer and K Satya Prasad ,Cengage Pub.
4. Principles of Linear Systems and Signals by B.P.Lathi, Oxford publications, Second Edition.

Reference books

1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Signals and Systems – K R Rajeswari
3. Fundamentals of Signals and Systems- Michel J. Robert, MGHInternational Edition, 2008.
4. **Signals and Stochastic Processes- Y Mallikarjuna Reddy and Giri Babu Kande, University Press, 1st edition.**

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/106/108106163/
2. https://nptel.ac.in/courses/108/104/108104100/
3. https://nptel.ac.in/courses/108/105/108105065/
4. https://nptel.ac.in/courses/117/104/117104074/
5. https://nptel.ac.in/courses/117/101/117101055/
6. https://nptel.ac.in/courses/108/106/108106075/

III Year I Semester

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ENERGY CONSERVATION & AUDITING

CourseObjectives:

1. To understand energy efficiency, scope, conservation and technologies.
2. To design energy efficient lighting systems.
3. To estimate/calculate power factor of systems and propose suitable compensation techniques.
4. To understand energy conservation in HVAC systems.
5. To calculate life cycle costing analysis and return on investment on energy efficient technologies

Unit-1 Basic Principles of Energy Audit and management (15h)

Energy audit – Definitions – Concept – Types of audit – Energy index – Cost index – Pie charts – Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions – Language – Questionnaire – Check list for top management

Unit-2 Lighting(15h)

Modification of existing systems – Replacement of existing systems – Priorities**:** Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level –Illumination of inclined surface to beam – Luminance or brightness – Types of lamps –Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light- LED and conducting Polymers – Energy conservation measures.

Unit-3 Power Factor and energy instruments (12h)

Power factor – Methods of improvement – Location of capacitors – Power factor with nonlinear loads – Effect of harmonics on Power factor – Numerical problems. Energy
Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters– Tong testers – Power analysis.

Unit-4 Space Heating and Ventilation (12h)

Ventilation – Air–Conditioning (HVAC) and Water Heating**:** Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air conditioning –Insulation– Cooling load – Electric water heating systems – Energy conservation methods.

Unit-5 Economic Aspects and Financial Analysis (14h)

Understanding energy cost - Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts) – Economics of energy efficient motorsand systems.

Course Outcomes

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

CO1 Explain energy efficiency, conservation and various technologies.

CO2 Design energy efficient lighting systems.

CO3 Calculate power factor of systems and propose suitable compensation techniques.

CO4 Explain energy conservation in HVAC systems

CO5 Calculate life cycle costing analysis and return on investment on energy efficient technologies.

Text books:

1. Hand Book of Energy Audit by Sonal Desai- Tata McGraw hill
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd–2nd edition, 1995.

Reference books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
3. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998.
4. Energy management hand book by W.C.Turner, John wiley and sons.
5. Energy management and conservation –k v Sharma and pvenkataseshaiah-I K International Publishing House pvt.ltd,2011.
6. http://www.energymanagertraining.com/download/Gazette_of_IndiaPartIISecI-37_25-08-2010.pdf

Website materials:

1. http://nptel.ac.in/courses/108104052/
2. http://freevideolectures.com/Course/2354/Power-Systems-Operation-and-Control
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Bombay/Power%20Systems%20Operation%20and%20Control.html

III Year I Semester

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HIGH VOLTAGE ENGINEERING

PRE-REQUISITES: 1) Physics & Chemistry

Course objectives: The student should be able to

1. Understand electric field distribution and computation in different configuration of electrode systems
2. Understand HV breakdown phenomena in gases, liquids and solids dielectrics
3. Acquaint with the generating principle of operation and design of HVDC, AC and Impulse voltages and currents
4. Understand various techniques of AC, DC and Impulse measurement of high voltages and currents**.**
5. Know the insulating characteristics of dielectric materials **and** various testing techniques of HV equipments

Unit-1 Introduction to High Voltage Technology (13Hrs)

Electric Field Stresses – Uniform and non–uniform field configuration of electrodes – Estimation and control of electric Stress – Numerical methods for electric field computation.

Unit-2 Break down phenomenon in gaseous, liquid and solid insulation (13 Hrs)

Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases – Paschen's law – Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquid – Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown –Breakdown of solid dielectrics, composite dielectrics used in practice.

Unit-3 Generation of High voltages and High currents (13 Hrs)

Generation of high DC voltages – Generation of high alternating voltages – Generation of impulse voltages and currents – Tripping and control of impulse generators.

Unit-4 Measurement of high voltages and High current (13Hrs)

Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse.

Unit-5 Testing of electrical materials and apparatus (13Hrs)

Measurement of DC resistivity – Measurement of dielectric constant and loss factor – Partial discharge measurements. Testing of insulators and bushings – Testing of isolators and circuit breakers – Testing of cables – Testing of transformers – Testing of surge arresters – Radio interference Measurements.

Course Outcomes

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

CO1 Acquainted **with the performance of high voltages with regard to different configurations of electrode systems. (**Analyze, KL4)

CO2 Understand **theory of breakdown and withstand phenomena of all types of dielectric materials (**understand, KL2)

CO3 Acquaint **with the techniques of generation of AC,DC and Impulse voltages (**understand, KL2)

CO4 Apply **knowledge for measurement of high voltage and high current AC, DC and Impulse. (**apply, KL3**)**

CO5 Experiment **to measure dielectric property of electrical material and know the techniques of testing various equipment's used in HV engineering (**Analyze, KL4)

Text books:

1. "**High Voltage Engineering: Fundamentals**", **E.Kuffel, W.S.Zaengl, J.Kuffel**, 2nd Edition, Elsevier, 2000.
2. "**High Voltage Engineering**", M.S.Naidu, V.Kamaraju, 3rd Edition, TMH, 2003.

Reference books:

1. "**High Voltage Engineering and Testing**", Ryan, 3rd Edition, IET Publishers, 2013.
2. "**High Voltage Engineering**", C.L.Wadhwa, 1st Edition, New Age Publishers, 1997.
3. "**High Voltage and Electrical Insulation Engineering**", Ravindra Aurora, Wolfgang Mosch, John Wiley Publications, 2011.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/104/108104048/
2. https://cds.cern.ch/record/1005044/files/p113

III Year I Semester

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NEURAL NETWORKS & FUZZY LOGIC

Pre-requisites: Not specific

Course Objectives:

1. To introduce the concept of artificial neuron models
2. To study various neural network architectures and learning strategies
3. To explain ANN paradigms and application of ANN to Electrical Engineering problems.
4. To introduce fuzzy set operations and relations.
5. To study the design of fuzzy logic system

Unit-1 Introduction to Neural Networks: (12hrs)

Introduction: (7hrs)

Introduction, Organization of the Human Brain, Organization of the Biological Neuron, Humans and Computers – Knowledge representation, Biological models- Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model.

Artificial Neurons: (5hrs)

Artificial Neuron model, Activation functions, MC Culloch-pitts neuron model, Design of basic logic gates using single artificial neuron.

Unit-2 Essentials of Artificial Neural Networks: (12hrs)

Artificial Neural Network Architectures: (7hrs)

Neural Network Architectures, Single layer feed forward networks: concept of Perceptron, learning algorithm for perceptron – linear separability- XOR function.

Learning strategies: (5hrs)

Learning methods (Supervised, Unsupervised and Reinforced), Learning rules (Rosenblatt's Perceptron learning rule, Delta rule, Hebbian rule, Competitive learning rule, Gradient Descent learning rule).

Unit-3 ANN Paradigm and its applications: (10hrs)

ANN Paradigms: (6hrs)

Multi-layer feed forward networks –Generalized delta rule– Back Propagation algorithm – Radial Basis Function (RBF) network.

Applications of ANN: (4hrs)

Speed control of DC and AC motors using Neural Network.

Unit-4 Classical and Fuzzy set Theory (14hrs)

Classical set Theory: (7hrs)

Introduction, Fuzzy versus crisp, properties of crisp sets- Verification of Demorgan's Law, Operations and relations of crisp sets.

Fuzzy set Theory: (7hrs)

Fuzzy sets, Membership functions, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy Cartesian Product, Operations on Fuzzy relations.

Unit-5 Fuzzy Logic System Design and Applications (12hrs)

Fuzzy Logic System Design: (7hrs)

Fuzzy Logic, Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based system, De-fuzzification methods.

Fuzzy Logic Control Applications: (5hrs)

Speed control of DC and AC motors using Fuzzy logic controller

Course Outcomes

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

CO1 Understand the concept of artificial neuron**.(Understand KL2, Analyze KL4)**

CO2 Know various ANN architectures and learning strategies. **(Understand KL2, Analyze KL4, Apply KL3)**

CO3 Understand ANN paradigm and its application to solve Electrical Engineering problems. **(Understand KL2, Apply KL3)**

CO4 Understand fuzzy set theory and membership functions. **(Understand KL2)**

CO5 Design Fuzzy Logic System for Electrical Engineering problems. **(Understand KL2, Apply KL3)**

Learning Resources

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S.Rajasekaran and G.A. Vijayalakshmi Pai – PHI Publication.
2. Fuzzy logic with fuzzy applications- by T.J. Ross, TMH.

Reference Books:

1. Introduction to Artificial Neural Systems – Jacek M. Zurada, Jaico Publishing House, 1997.
2. Fundamentals of Neural Networks Architectures, Algorithms and Applications - by laurene Fausett, Pearson.
3. Neural Networks, Algorithms, Applications and programming Techniques by James A. Freeman, David M. Skapura.
4. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam, S Sumathi, S N Deepa TMGH

III Year I Semester

L	T	P	C
3	0	0	3

ADVANCED PYTHON PROGRAMMING

PRE-REQUISITES:

- Fundamentals of Python
- Problem solving skills

Course objectives: The student should be able to

1. Able to learn advanced concepts in Python
2. Able to use advanced packages like numpy, scipy, opencv in Python for building data processing & visualizing applications.
3. Able to process digital imaging applications

Unit-1 Python Fundamentals: Introduction to Python, Data Structures – List, Dictionaries, Sets and Tuples. **(6 hrs)**

Modules, Python Packages, Libraries: Modules - Creating modules, import statement, from Import statement, name spacing. Math Module: Constants, Power and logarithmic functions, Trigonometric functions. Numpy Library: Numpy import, Basic functions, Matrices Addition, Subtraction Multiplication, Transpose, Inverse, Eigen values and Eigenvectors using Numpy **(8hrs)**

Unit-2 Python packages: Introduction to PIP, Installing Packages via PIP, Using Python Packages **(4hrs)**

Data Visualization – Matplotlib - Loading the library and importing the data, How Mat plot lib works?, modifying the appearance of a plot, Plotting multiple plots, Modifying the tick marks, Scatter plots, Bar plots. **(8hrs)**

Unit-3 File Handling – Introduction to Files, File modes, Reading, Writing data from files, Copy one file to another, deletion of files. Other file programs in Python. **(4hrs)**

Text Processing: Word, character and line counting, Frequency count. Usage of with() and split(). Reading and writing into CSV formats**.** **(8hrs)**

Unit-4 Image Processing - Installing Jupiter notebook. Image & Its properties. Image processing applications. Image I/O and display with Python, Reading, saving and displaying an image using Open CV - PyPI, matplotlib

Sample programs – Image statistics Croping, Converting images from RGB to Gray and resizing the image. **(12 hrs)**

Unit-5 Using Databases and SQL – Introduction to Database Concepts, usage of SQLite, Create, Insert & Retrieve data, Spidering twitter using a database. Sample Python codes **(8 hrs)**

Course Outcomes

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

CO1 **Recall** the usage of Python Concepts.
CO2 **Use** different Python packages for Data Visualization
CO3 **Demonstrate** File handling & text processing
CO4 **Demonstrate** applications that performs Image processing
CO5 **Connect** database with Python.

Text books:

1. Python for Everybody: Exploring Data Using Python 3, Charles Severance
2. The Hitchiker's Guide to Python, O'Reilly publications

Reference books:

1. Hands-On Image Processing with Python, O'Reilly Publications
2. *Think Python*, Allen Downey, Green Tea Press

e- Resources & other digital material

6. https://nptel.ac.in/courses/117/105/117105079/
7. https://nptel.ac.in/courses/106/106/106106145/#
8. https://realpython.com/python-mysql/

III Year I Semester

L	T	P	C
3	0	0	3

BLOCKCHAINTECHNOLOGIES

Unit-1 INTRODUCTION: Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain.
Evolution of Blockchain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments

Unit-2 BLOCKCHAIN CONCEPTS: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.

Unit-3 ARCHITECTING BLOCKCHAIN SOLUTIONS: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications, Cryptographic Tokens, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.

Unit-4 ETHEREUM BLOCKCHAIN IMPLEMENTATION: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Ether scan, Ethereum Clients, Decentralized Application, Meta mask.

Unit-5 ADVANCED CONCEPTS IN BLOCKCHAIN: Introduction, Inter Planetary FileSystem (IPFS),Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

Course Outcomes

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

CO1 Describe various blockchain fundamentals

CO2 Explain the working mechanism of a blockchain and smart contracts

CO3 Illustrate different blockchain applications and their architectural styles

CO4 Explain the implementation of blockchain in the Ethereum ecosystem

CO5 Explain advanced concepts of blockchain and its integration with IoT

Text books:

1.“Blockchain for Enterprise Application Developers”, Ambadas, Arshad Sarfarz Ariff,Sham-Wiley
2.“Mastering Bit coin: Programming the Open Blockchain”, Andreas M.Antonpoulos,O’Reilly.

Reference books:

1. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, PaulR.Allen, McGrawHill.
2. Blockchain: Blue print for aNew Economy, Melanie Swan,O’Reilly

e- Resources & other digital material

https://github.com/blockchainedindia/resources

III Year I Semester

L	T	P	C
3	0	0	3

DIGITAL SYSTEM DESIGN WITH VHDL

PRE-REQUISITES: Digital Circuits & Logic Design

Course objectives: The student should be able to

1. To understand various Digital Logic Families and their Interfacing
2. To know the basics of VHDL and programming models
3. To implement digital systems using VHDL
4. To design and implement combinational circuits using VHDL code and relevant ICs
5. To design and implement sequential circuits using VHDL code and relevant ICs.

Unit-1: Digital Logic Families- (16 hours)

Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behaviour, CMOS logic families. Bipolar logic, Transistor-Transistor logic and TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic, Parameters to choose logic families for the design applications.

Unit-2: Introduction to VHDL- (13 hours)

Introduction to HDL, design flow with VHDL, Program structure in VHDL. Levels of abstraction, VHDL elements: data types, data objects, operators and identifiers. VHDL programming models: data flow, structural and behavioral with examples on simple combinational and sequential circuits.

Unit-3: Digital Design Using VHDL-(12 hours)

Concurrent vs. Sequential statement, *Concurrent statements:* WHEN, GENERATE, BLOCK. Process: single and multiple, variable assignment vs signal assignment. *Sequential statements:* IF, WAIT, CASE, LOOP, NULL, EXIT, ASSERTION, CASE vs IF, CASE vs WHEN. Delay Models: Inertial and Transport, Comparison of VHDL with other procedural languages.

Unit-4: Combinational Logic IC Design- (12 hours)

Adders: Ripple Carry, Carry Look ahead, Adder-Sub tractors, Multiplexers, Decoders/De-multiplexers, Encoders: Priority Encoders, Parity Checkers, ALU, Comparators, Design considerations of these combinational circuits using VHDL code and relevant IC.

Unit-5: Sequential Logic IC Design-(13 hours)

SSI Latches and Flip-flops, Shift Registers, Synchronous and Asynchronous Counters, Ring and Johnsons Counter, Applications: Sequence detector, Traffic light controller, Vending machine controller, Signal Generator, Serial data receiver. Design considerations of these sequential circuits using VHDL code and relevant IC

Course Outcomes

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

CO1 **Understand** the structural description and electrical characteristics of various digital logic families. **{Understand level, KL2}**

CO2 **Understand** the basics of HDL and Programming models of VHDL.**{Understand level, KL2}**

CO3 **Implement** digital systems using VHDL. **{Analyze level, KL4}**

CO4 **Implement** the Combinational logic using ICs and VHDL code. **{Evaluate level, KL5}**

CO5 **Model**the Sequential circuits using ICs and VHDL code**{Apply level, KL4}**

Text books:

1. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.
2. Circuit Design with VHDL - V. A. Pedroni, MIT Press, Cambridge, 2004.
3. VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.
4. Cem Unsalan, Bora Tar "Digital System Design with FPGA: Implementation using Verilog and VHDL ", McGraw Hill Education. 2017

Reference books:

1. Fundamentals of Digital Logic with VHDL Design- Stephen Brown, ZvonkoVranesic, McGrawHill, 3rd Edition, 2009.
2. Digital systems principles and Applications-Ronald J. Tocci, Neal S.Widmer, Eighth Edition, Prentice Hall.
3. VHDL: Programming by Example- Douglas L. Perry, Fourth Edition, Tata McGraw-Hill, 2003.
4. Digital Logic Circuit Analysis and Design - V. P. Nelson, H.T. Nagle, B.D. Carroll, and D. Irwin, 1st Edition, Prentice Hall International, 1995

e- Resources & other digital material

1. https://technobyte.org/vhdl-course-tutorials/
2. http://www.secs.oakland.edu/~llamocca/VHDLforFPGAs.html
3. https://www.fpga4student.com/p/vhdl-project.html

III Year I Semester

L	T	P	C
0	0	3	1.5

ELECTRICAL MACHINES-II LAB

PRE-REQUISITES: 1) Electrical Machines-1 Theory

Preamble: Electrical Machines-II Lab provides the essential facilities to the students to augment their concepts about the fundamentals of rotating Asynchronous and Synchronous machines. The lab is equipped with three phase induction motors, synchronous generators, synchronous motor and Single phase induction motor. The lab covers the determination of performance characteristics, speed control method of induction motor, voltage regulation of synchronous generator and v and inverted v curves of synchronous motor.

Course Objectives: The student should be able to

1. To control the speed of three phase induction motors.
2. To determine /predetermine the performance of three phase induction.
3. To determine /predetermine the performance of single phase induction.
4. To improve the power factor of single phase induction motor.
5. To predetermine the regulation of three–phase alternator by various methods, find Xd/ Xq ratio of alternator and asses the performance of three–phase synchronous motor.

LIST OF EXPERIMENTS

Any Ten of the following experiments are to be conducted:

1. Brake test on three phase Slip ring Induction Motor
2. No–load & Blocked rotor tests on three phase Slip ring Induction motor
3. Load test on single phase induction motor.
4. Equivalent circuit of single phase induction motor
5. Regulation of a three –phase alternator by synchronous impedance method
6. Regulation of a three –phase alternator by M.M.F method
7. Regulation of three–phase alternator by Potier triangle method
8. Determination of Xd and Xq of a salient pole synchronous machine
9. V and Inverted V curves of a three—phase synchronous motor.
10. Determination of efficiency of three phase alternator by loading with three phase induction motor.
11. Determination of sub transient direct axis (Xd'') and quadrature axis (Xq") synchronous reactance of an alternator.
12. To perform parallel operation of two alternators.

List of Additional Experiments: Any of the two experiments are to be conducted

1. Brake test on three phase Squirrel cage Induction Motor.
2. Determination of the symmetrical impedances of a synchronous machine.
3. Speed control of induction motor by V/f method.

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

Course Outcomes

CO1 Able to assess the performance of three phase induction motor. (**Analyze**)

CO2 Able to control the speed of three phase induction motor. (**Remember and Understand**)

CO3 Able to assess the performance of single phase induction motor. (**Analyze**)

CO4 Able to predetermine the regulation of three–phase alternator by various methods. (**Evaluate**)

CO5 Able to find the Xd / Xq ratio of alternator and asses the performance of three–phase synchronous motor. (**Understand, Apply and Analyze**).

Text books:

1. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria & Sons.
2. Electrical Machines – P.S. Bhimbra, Khanna Publishers.

Reference books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, Mc Graw Hill Publications, 4th edition.
2. Electrical Machinery by Abijith Chakrabarthi and Sudhipta Debnath, Mc Graw Hill education 2015.
3. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010.
4. Electric Machinery by A.E. Fitzgerald, Charles kingsley, Stephen D.Umans, TMH.

e- Resources & other digital material

1.https://nptel.ac.in/courses/108/105/108105017

2.https://nptel.ac.in/courses/103/102/108102146

3.www.nptelvideos.in/2012/11/electrical-machines-i.html

4. https://www.electrical4u.com/losses-in-dc-machine

III Year I Semester

L	T	P	C
0	0	3	1.5

IoT LAB

Pre-Requisites:

A course on " C + + Programming ".
A course on "Python Programming".

Course objectives:

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design &develop IOT Devices.

List of Experiments:

1. Basic program and device interfacing for Arduino and Node MCU and operating system installation in Raspberry pi.
2. Interfacing LCD with Arduino, Node MCU and raspberry pi.
3. Interfacing DHT11 humidity sensor with raspberry pi and Arduino.
4. Intruder detection using PIR sensor using Arduino and raspberry pi
5. Distance measurement using Ultrasonic sensor by connecting to Arduino and Raspberry pi
6. ESP8266 WI-FI Module Interface with Arduino and DHT11 data upload to the cloud server.
7. Motor forward and reverse control using L293D motor driver Arduino and raspberry pi.
8. Voice – Activated Arduino Bluetooth Android.3 and Raspberry pi.
9. Measuring pulse and spo2 in body using MAX30100 sensor and data uploading to cloud using Arduino ESP8266 and raspberry pi.
10. Measuring soil moisture using REES52 sensor and data uploading to cloud using Arduino ESP8266 and raspberry pi.
11. Detecting poisonous gas using MQ-2 gas sensor and data uploading to cloud using Arduino ESP8266 and raspberry pi
12. IoT based smart energy meter using Arduino and Raspberry pi
13. Installation of NodeJS on Raspberry Pi and connecting sensor for data monitoring.
14. Develop IoT based smart lock system for Motorcycle/Car
15. Develop IoT based Smart water flow system
16. Develop IoT based home security system
17. Develop IoT based smart Ignition for Motorcycle/Car
18. Develop IoT based fuel level indication system in Automobile.

Software(s) used:

1. For Arduino and Node MCU software used is Arduino IDE
2. For Raspberry pi operating raspbian OS

Course Outcomes:

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

CO1	Determine the various codes of Arduino, Nodemcu& Raspberry pi Programming.
CO2	Differentiate the features of various IOT platforms.
CO3	Able to choose the best available IOT principle for solving the problem
CO4	Able to design simple IOT applications using Arduino, NodeMcu and Raspberry pi boards

Text books:

1. AdrianMcEwen, “Designing the Internet of Things”, Wiley Publishers, 2013, ISBN:78-1-118-43062-0
2. Daniel Kellmereit, “The Silent Intelligence: The Internet of Things”. 2013, ISBN0989973700

e-resources:

1. https://circuitdigest.com/internet-of-things-iot-projects.
2. https://create.arduino.cc/projecthub/projects/tags/raspberry%2Bpi.
3. https://create.arduino.cc/projecthub/projects/tags/iot.
4. https://iotdesignpro.com/iot-projects.

III Year I Semester

L	T	P	C
0	0	3	1.5

POWER ELECTRONICS LAB

Pre-Requisites: 1) Basic Circuit Analysis
2) Engineering Mathematics

Preamble: Introduction to Power Electronics– various power electronics devices, Pulse width modulation, AC to DC Converters, AC Voltage Regulator and DC to AC Converters.

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Course objectives: The student should be able to

1. Study the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
2. Analyze the performance of single–phase and three–phase full–wave bridgeconverters with both resistive and inductive loads.
3. Understand the operation of AC voltage regulator with resistive and inductive loads.
4. Understand the working of Buck converter, Boost converter and inverters.

List of Experiments: Any 10 of the following experiments are to be conducted

1. Study of Characteristics of Thyristor, MOSFET & IGBT.
2. Design and development of a firing circuit for Thyristor.
3. Design and development of gate drive circuits for IGBT.
4. Single -Phase Half controlled converter with R and RL load
5. Single -Phase fully controlled bridge converter with R and RL loads.
6. Single -Phase AC Voltage Regulator with R and RL Loads
7. Single -Phase square wave bridge inverter with R and RL Loads
8. Three- Phase fully controlled converter with RL–load.
9. Design and verification of voltages gain of Boost converter.
10. Design and verification of voltages gain of Buck-Boost converter.
11. Single -phase PWM inverter with sine PWM technique.
12. 3-phase AC-AC voltage regulator with R-load.

List of Additional Experiments: Any 2 of the following experiments are to be conducted

1. Study of Characteristics of NPN Transistor.
2. Design and verification of voltages gain of Buck converter.
3. Three -phase PWM inverter with sine PWM technique.

Course Outcomes:

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

CO1 Study the characteristics of various power electronic devices and analyze gate drive circuits of IGBT.

CO2 Analyze the performance of single phase and three phase full wave bridge converters with both resistive and inductive loads.

CO3 Understand the operation of single phase AC voltage regulator with resistive and

inductive loads.

CO4 Understand the working of Buck converter, Boost converter, single phase square wave inverter and PWM inverter.

Text books:

1. Elements of Power Electronics–Philip T.Krein.oxford.
2. 2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.

e-resources:

5. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/power_electronics/labs/index.php
6. https://www.vlab.co.in/broad-area-electrical-engineering
7. https://www.vlab.co.in/broad-area-electronics-and-communications

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III Year II Semester

L	T	P	C
3	0	0	3

HIGH VOLTAGE AC & DC TRANSMISSION

PRE-REQUISITES: 1) Power Electronics,
2) Power Systems-I & II

Course objectives: The student should be able to

1. To understand the phenomena associated with transmission line, operating at extra high voltages and detail analysis of several phenomena viz. electrostatic field, charges, voltage gradient and conductor configuration
2. The objective is to discuss phenomena of corona, losses, audible noise, radio interference and measurement of these quantities.
3. To understand the phenomena of HVDC, HVDC equipment comparison with AC and the latest state of art in HVDC transmission.
4. To understand method of conversion of AC to DC, performance of various level of pulse conversion and control characteristics of conversion
5. To understand the requirements of reactive power control and filtering technique in HVDC system and to understand the harmonics in AC side of power line in a HVDC system and design of filters

Unit-1 Introduction of EHV AC transmission (13 hrs)

Necessity of EHV AC transmission – Advantages and problems – Power handling capacity and line losses – Mechanical considerations – Resistance of conductors - Electrostatics – Field of sphere gap – Field of line charges and properties **(07hrs)**

Charge ~ potential relations for multi–conductors – Surface voltage gradient on conductors – Bundle spacing and bundle radius Examples – Distribution of voltage gradient on sub conductors of bundle – Examples. **(06 hrs)**

Unit-2 Corona effects(11 hrs)

Power loss and audible noise (AN) – Corona loss formulae – Charge voltage diagram – Generation – Characteristics – Limits and measurements of AN **(05hrs)**

Radio interference (RI) – Corona pulses generation – Properties and limits –Biological effects Electrical and magnetic fields on human beings and animals- Recent advances in UHV power transmission**(06 hrs)**

Unit-3 Basic Concepts of DC Transmission(13 hrs)

Basic Concepts of DC Transmission Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems **(07 hrs)**

Comparison of AC &DC transmission – Application of DC Transmission System – Planning & Modern trends in DC transmission.**(6hrs)**

Unit-4 Analysis of HVDC Converters and System Control(13 hrs)

Choice of Converter configuration – Analysis of Graetzciruit – Characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star – Star mode and their performance **(7 hrs)**

Principal of DC Link Control - Converters Control Characteristics – Firing angle control – Current and extinction angle control– Starting and stopping of DC link – Power Control. **(6 hrs)**

Unit-5 Reactive Power Control, Harmonics and Filters in HVDC(15 hrs)

Reactive Power Requirements in steady state – Conventional control strategies –Alternate control strategies sources of reactive power – AC Filters – Shunt capacitors – Synchronous condensers. **(6 hrs)**

Harmonics and Filters Generation of Harmonics – Characteristics harmonics – Calculation of AC Harmonics – Non–Characteristics harmonics – Adverse effects of harmonics – Calculation of voltage & current harmonics – Effect of Pulse number on harmonics. Types of AC filters, Design of Single tuned filters – Design of High pass filters..**(9 hrs)**

Course Outcomes

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

CO1 Acquaint with HV transmission system with regard to power handling capacity, losses, conductor resistance and electrostatic field associate with HV**{Understand level, KL2}**

CO2 To develop ability for determining corona, radio interference, audible noise generation and frequency spectrum for single and three phase transmission lines.**{ Analyze level, KL4}**

CO3 To acquire knowledge in transmission of HVDC power with regard to terminal equipment, type of HVDC connectivity and planning of HVDC system **{ Understand level, KL2}**

CO4 To be able to develop knowledge with regard to choice of pulse conversion, control characteristic, firing angle control and effect of source impedance. **{ Analyze level, KL4}**

CO5 To develop knowledge of reactive power requirements of conventional control, filters and reactive power compensation in HVDC system, calculate voltage and current harmonics, and design of filters. **{ Analyze level, KL4}**

Text books:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers.
2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
3. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (P) Ltd..

Reference books:

EHVAC and HVDC Transmission Engineering and Practice – S.Rao.
Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications
HVDC Transmission – J. Arrillaga.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/102/108102047/
2. https://www.coursera.org/learn/electric-power-systems

III Year II Semester

L	T	P	C
3	0	0	3

ADVANCED CONTROL SYSTEM

PRE-REQUISITES: 1) Control System
2) Analog Circuits -1
3) Engineering Mathematics -1

Course objectives: The student should be able to

1) To study the basic theory required for solving complex control problems.
2) To do analysis and modeling of systems and signals.

Unit-1 Concept of state space-state space representation of system, solution of time invariant state equation- state transition matrix. Linear time varying
System. Discrete system state space representation and solution (7hrs)

Unit-2 Non-linear system, types of non-linearity, singular point, non-linear system stability analysis- phase plane technique, construction of phase trajectories, isocline method. (8Hrs)

Unit-3 Describing function analysis : Basic concepts, derivation of describing functions for common non-linearities

Describing function analysis of non-linear systems – Conditions for
stability – Stability of oscillations. (9Hrs)

Unit-4 Lyapunov stability analysis- definition of stability, instability and asymptotic stability. Lyapunov stability theorems. Stability analysis of
simple linear systems. (9Hrs)

Unit-5 MIMO systems-controllability- Observability- Effect of pole-zero cancellation, Practical examples-controllable and uncontrollable systems- observable and unobservable systems. Optimal control system-definition- design using state variable feedback and error squared performance
indices. (9Hrs)

Course Outcomes

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

CO1 Graduates will be able to understand different state model of a system, and have the knowledge to find its solution. **{Knowledge & Understand (1 & 2) }**

CO2 Graduates will be able to understand nonlinear system models, and analyse its stability. {**Understand & Analyze (2 & 4)}**

CO3 Graduates will be able to analyse the describing function analysis of various nonlinear systems. {**Analyze (4)**}

CO4 Graduates will be able design different systems and analyse its stability using Lyapunov stability analysis.{ **Analyze & Design (4 & 6)**}

CO5 Graduates will be industry ready by analysis of controllability and observability of the dissimilar system. {**Analyze (4)**}

Text books:

1. “Discrete Time Control Systems”, K. Ogata, PHI, 1996.
2. “Modern Control Engineering”, K. Ogata, PHI, 1996.
3. Modern Control Systems, R. C. Dorf and R. H. Bishop, 8th ed., Pearson Education, Delhi, 2004.

Reference books:

1. Process Control Instrumentation Technology, C. D. Johnson, 7th ed., Prentice Hall of India, New Delhi, 2003.
2. “Modern Control System Theory”, M. Gopal, New Age International Publishers, 2nd edition,1996.
3. “Digital control and state variables methods”, Madangopal, PHI, 1997.
4. Modern control engineering – Katsuhiko Ogata, Pearson Edn.

e- Resources & other digital material

1. http://nptel.iitm.ac.in/courses/108101037/
2. http://nptel.iitm.ac.in/video.php?subjectId=108102043
3. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Control%20system%20design%20n%20principles/index.htm

III Year II Semester

L	T	P	C
3	0	0	3

ELECTRICAL MACHINE DESIGN

PRE-REQUISITES: 1) Electrical Machines-I
2) Electrical Machines-II
3) Special Electrical Machines

Course objectives: The student should be able to

1. Study the Principles of Design of static and rotating machines.
2.To understand the design of cooling system of transformers
3.Know the main dimensions of static and rotating machines, field coil, stator and rotor.

Unit- 1 D.C. Machines (13 hrs)

E.M.F generated from full pitch -fractional pitch with and without distributed windings - distribution factor. Design of main dimensions from output equation.

Design of Armature winding- Design of field system

Unit-2 Transformers (12 hrs)

Derivation of output equation -volt per turn importance and calculation of main dimensions for three phase and single phase transformers -window dimensions.

Yoke design and coil design –Design of transformer tank with tubes.

Unit-3 Induction Motor (12 hrs)

Derivation of output equation -calculation of main dimensions -Stator design -number of slots - shape and area of slots.

Rotor design for squirrel cage and slip ring types.

Unit-4 Synchronous Machines (12 hrs)

Derivation of output equation –Calculations of Main Dimensions for salient pole and cylindrical rotor alternators.

Stator design -number of stator slots and slot dimensions, Pole design for salient pole generators.

Unit- 5 Computer Aided Design (9 hrs)

Advantage of computer aided design –Flow chart for computer aided design.

Course Outcomes

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

- **CO1** **Understand** the basic concepts of electrical machine design and the principles of computerized design of electrical machines **{Understand level, KL2}**
- **CO2** **Understand** the specifications and design of main dimensions of transformer, cooling systems **{ Understand level, KL2}**
- **CO3** **Evaluate** the design of dc machine and performance calculations**{ Evaluate level, KL5}**
- **CO4** **Analyze** the design of induction motor stator & rotor**{ Apply level, KL4}**
- **CO5** **Analyze** the design of synchronous machine (both. Salient pole & non-salient pole).**{Apply level, KL4}**

Text books:

1.A.K. Sawhney, A Course in Electrical machine Design, Dhanpatrai& Sons,
2.M.G. Say, Performance and Design of AC Machines, CBS.

Reference books:

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

e- Resources & other digital material

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

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

III Year II Semester

L	T	P	C
3	0	0	3

RENEWABLE ENERGY SOURCES

(Professional Elective –II)

PRE-REQUISITES: 1) Basics of Solar Energy

Preamble: This course gives a flavor of renewable sources and systems to the students. It introduces solar energy its radiation, collection, storage and its applications. This covers generation, design, efficiency and characteristics of various renewable energy sources including solar, wind, hydro, Fuel cells and geothermal systems.

Course objectives: The main objectives are

1. To study the solar radiation data, extraterrestrial radiation. Radiation on earth's surface.
2. To study solar thermal collections.
3. To study solar photo voltaic systems.
4. To study wind energy conversion systems Betz coefficient systems tip speed ratio.
5. To study basic principle and working of hydro, tidal, fuel cell and geothermal systems.

Unit-1 Solar Energy Systems and Solar Geometry

Solar Energy Systems:

Energy conservation principle – Energy scenario (world and India) – various forms of renewable energy - Solar radiation**:** Outside earth's atmosphere – Earth surface – Analysis of solar radiation data.

Solar Geometry:

Latitude angle-Zenith angle- Altitude angle- Declination angle-Solar azimuth angle- Slop- Surface azimuth angle- angle of incidence- Solar Time-Hour angle- Sunrise, Sunset and daylight– Radiation on tilted surfaces – Numerical problems.

Unit-2 Solar Thermal and Solar Photovoltaic Systems

Solar Thermal Systems

Introduction-Liquid flat plate collectors-Performance Analysis– Concentrating collectors & its types-Applications (Solar pond, Solar Water heater, Solar Cookers & Solar still).

Solar Photovoltaic Systems

Solar photovoltaic cell, module, array – Construction –Solar Cell I-V characteristics –Equivalent circuit -Maximizing the performance of solar cell – Solar PV Systems.

Unit-3 PV System design and Wind Energy System

PV System design:

Balance of system components – PV System design**:** storage sizing – PV system sizing – Maximum power point techniques**-** Perturb and observe (P&O) technique.

Wind Energy Syatem

Sources of wind energy - Power in Wind- Wind Energy Conversion System-Wind Turbine-operating characteristics-Types of turbines– Power output of wind turbine- Selection of generator– Maximum power point tracking.

Unit-4 Hydro and Tidal power systems

Hydro power systems:

Basic working principle – Conversion of Hydro Power-Classification of small hydropower Plant-

Operation of Micro Hydro Power Plant– Types of Water turbines.

Tidal power systems:

Origin of Tides - Tidal Energy – Operation of Tidal plant - Tidal energy conversation Schemes – Numerical problems.

Wave Energy: Power Associated to Wave – Wave Energy Conversion devices.

Unit-5 Fuel cells and geothermal systems

Fuel cell:

Basic Working Principle - Classification of fuel for fuel cells – Fuel cell voltage– Efficiency – V-I characteristics-Application.

Geothermal:

Resources- Geothermal based electric power generation - Classification – Dry steam –Wet steam- Hot water Resources–Hot Dry Rock Resources.

Course Outcomes

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

CO1	**Analyze solar radiation data,** extraterrestrial radiation. radiation on earth's surface.**{Apply level, KL4}**
CO2	Design solar thermal collectors, solar thermal plants. **{Evaluate level, KL5}**
CO3	Design solar photo voltaic systems and wind energy conversion systems. **{Evaluate level, KL5}**
CO4	Understand working of hydro, tidal and wave power plant operations.{**Understand level, KL2}**
CO5	**Explain** importance of fuel cell and geothermal system .**{Explain level, KL3}**

Text books:

1. "Solar Energy" Principles of thermal collections and storage, S. P. Sukhatme, and J.K. Nayak, TMH ,New Delhi, 3nd edition.
2. "Renewable Energy Resources" Johan Twidell and Tony Weir, Taylor and Fancies 2rd edition, 2013.

Reference books:

1. "Renewable Energy" Edited by Godfrey, Boyle-Oxford University press 3rd edition, 2013.
2. "Renewable Energy Technologies/Ramesh and Kumar Narosa
3. "Renewable Energy Technologies" A Practical Guide For Beginners

e- Resources & other digital material

1. https://nptel.ac.in/courses/112105051
2. https://www.tatapower.com/bussiness/renewable-energy.aspx
3. https://www.cleanlineenergy.com/technology/wind-and-solar
4. https://www. youtube.com/watch?=xokHLFE96h8
5. https://www.youtube.com/watch?v=GZKKWz_tX1c

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III Year II Semester

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MICROPROCESSORS AND MICROCONTROLLERS

Pre-Requisites: Digital Electronics

Preamble: The Purpose of the course is to provide students with the Knowledge of Microprocessors and Microcontroller. To solve real world problems in an efficient manner, this course also emphasis on architecture, Programming and system design used in various day to day gadgets.

Course objectives: The student should be able to

1. To understand the organization and architecture of Micro Processor
2. To understand addressing modes to access memory and modes of operation
3. To interface different devices to 8086.
4. To understand 8051 micro controller architecture
5. To understand the basics of PIC18 architecture and develop programs using C.

Unit-1 Introduction to Microprocessor Architecture (13h)

Introduction and evolution of Microprocessors,8086 Pin diagram- Architecture of 8086, Register Organization of 8086, Memory organization of 8086– General bus operation of 8086–Introduction to 80286–80386 and 80486 and Pentium [Elementary treatment only]

Unit-2 Minimum and Maximum Mode Operations (10h)

Instruction set- Addressing modes, Minimum and Maximum mode operations of 8086- Read and write cycle timing diagrams, 8086 Control signal interfacing

Unit-3 I/O Interface(20h)

8255 PPI– Architecture of 8255–Modes of operation–Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing, DMA controller (8257)–Architecture– Modes of operations, Programmable Interrupt Controller (8259)–Modes of Operation- Command words of 8259,Keyboard/display controller (8279)–Architecture–Modes of operation[Elementary treatment only]

Unit-4 Introduction to 8051 Micro Controller (12h)

Introduction to 8051 Micro Controller– Architecture– Register set, I/O ports, Memory Organization– Interrupts, Timers and Counters–Serial Communication.

Unit-5 Introduction to PIC Micro Controller (10h)

Block diagram of basic PIC 18 micro controller, registers I/O ports, Data types, I/O programming, logical operations, data conversion.

Course Outcomes

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

CO1 Understand the concepts of 8086 architecture, register and memory organization**{Knowledge level, KL1}**

CO2 Understand and apply the concepts of the modes of operations and instruction set to develop the Assembly level language programs. **{Apply level, KL3}**

CO3 Classify the types of interfacing devices and implement to interface with 8086 **{Knowledge level, KL1}**

CO4 Explain the 8051 architecture and its features. **{Knowledge level, KL1}**

CO5 Understand the PIC18 architecture and Develop the programs using C **{Apply level,**

KL3}

Text books:

1. "**Advanced Micro Processors and Interfacing**", Ray and Burchandi, Tata McGraw–Hill
2. "**The 8051 Micro Controller Architecture, Programming and Applications**", Kenneth J Ayala, Thomson Publishers, 2nd Edition.
3. "**PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18"**, Muhammad Ali Mazidi, RolindD.Mckinay, Danny causey, Pearson Publisher 21st Impression.

Reference books:

1. "**A Text book of Microprocessors and Micro Controllers**", R.S. Kaler, I.K. International Publishing House Pvt. Ltd.
2. "**Microcontrollers – Theory and Applications**", Ajay V. Deshmukh, Tata McGraw– Hill Companies –2005
3. "**Microcontrollers – Principles and Applications**", Ajit Pal, PHI Learning Pvt Ltd, 2011.
4. **"Microprocessors and Interfacing**", Douglas V Hall, Mc–Graw Hill, 2nd Edition.

e-resources:

1. https://nptel.ac.in/courses/108107029/

III Year II Semester

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ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Pre-Requisites: 1) Basic Circuit Analysis

Preamble: This course introduces the principle of operation of basic analog and digital measuring instruments for measurement of current, voltage, power, energy etc. Measurement of resistance, inductance and capacitance by using bridge circuits will be discussed in detail. It is expected that student will be thorough with various measuring techniques that are required for an electrical engineer.

Course objectives: The student should be able to

1. Study the principle of operation and working of different types of instruments for measurement of electrical quantities.
2. Study the working principle of operation of different types of instruments for measurement of power and power factor, energy and frequency.
3. Understand the principle of operation and working of various types of bridges for measurement of parameters –resistance, inductance, capacitance and frequency.
4. Know the principle of operation and working of transducers and CRO.
5. Study the principle of operation and working of DVMs, DMM and other digital instruments.

Unit-1 Measuring Instruments& Instrument Transformers: Error analysis; Classification – Deflecting, Controlling and Damping torques – PMMC, MI, Electrodynamometer type instruments– Expression for torque. Extension of ranges using Shunts and Multipliers-numerical problems
Instrument transformers: C.T& P.T: Principle of operation and working.

Unit-2 Measurement of Power, Power factor & Energy: Single phase and three phase dynamometer wattmeter: LPF and UPF; Expression for deflecting and control torques; Measurement of active and reactive powers in balanced and unbalanced systems-Numerical problems
Type of P.F. Meters – Single phase and three phase dynamometer and moving iron type (Elementary treatment only)
Single phase induction type energy (Elementary treatment only)
Electrical resonance type frequency meter and Weston type synchro scope, Phase sequence indicator (Elementary treatment only)

Unit-3 Potentiometers & Bridges

Potentiometers: Principle and operation of D.C. Crompton's potentiometer – Standardization – Measurement of unknown resistance – Current – Voltage. AC Potentiometers: polar and coordinate types – Standardization (Elementary treatment only).

Bridges: Kelvin's double bridge, Wheat stone's bridge, Measurement of high resistance by loss of charge methods – Megger; Measurement of Inductance & Capacitance: Maxwell' bridge, Anderson's bridge, Hays bridge, Wien's bridge, Schering's bridge, Wagner's earth device

Unit-4 Transducers

Transducers: Q-meters, Definition and Classification of Resistive, Inductive and Capacitive Transducer, LVDT, Strain Gauge,Thermistors, Thermocouples, Piezo electric and Photo Diode Transducers, measurement of non-electrical quantities – Pressure- Angular velocity- liquid level.

Unit-5 Digital Meters: Advantages of Digital meters**,** Principle of operation of Ramp, dual–Slope integration continuous balance type DVM's - Successive approximation DVM's, digital multi-meters,

digital phase & frequency meters and digital tachometer.

Course Outcomes

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

CO1	Choose suitable instrument for measurement of ac and dc Electrical quantities.{Apply level, KL3}
CO2	Understand the concepts used in measurement of power, power factor, and energy & know the application of synchroscope and sequence indicators.{Understanding level, KL2}
CO3	Select suitable bridge for measurement of electrical parameters.{Apply level, KL3}
CO4	Acquire proper knowledge to use various types of Transducers and able to measure various non-electric quantities & frequency of signals with CRO{Apply level, KL3}
CO5	Acquire proper knowledge and working principle of various types of digital instruments {Apply level, KL3}

Text books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney, Dhanpat Rai & Co 17th edition 2000.
2. Electronic Instrumentation by H S Kalsi, 2nd Edition, McGraw-Hill Publishing, 2004.
3. Electrical Measurements and measuring Instruments - by E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing, 1999.

Reference books:

1. Electrical and Electronic Measurements and instrumentation by R.K.Rajput, S.Chand.
2. Electrical Measurements by Harris John Wiley.
3. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers.

e- Resources & other digital material

1. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee44

III Year II Semester

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POWER SYSTEMS-III

Pre-Requisites: Power Systems-I and Power Systems-II

Preamble:

The course is designed to give the required knowledge for the calculation of power flow in a power system network using various techniques, short circuit analysis, power system analysis for steady state and transient stability. It also deals with economic operation of power systems, modelling of speed governing system, turbines and generators including single area and two area load frequency control.

Course Objectives:

1.To study the Gauss Seidel, Newton Raphson, Decoupled and Fast Decoupled load flow methods.
2.To understand the short circuit calculations for symmetrical and unsymmetrical faults.
3.To study the stability analysis of power systems.
4.To understand optimal dispatch of generation with and without losses.
5.To study the load frequency control for single and two area system.

Unit-1 Power Flow Studies (13hrs)

Necessity of power flow studies, Derivation of static power flow equations, Load flow solutions using Gauss Seidel Method, Newton Raphson Method, Decoupled and Fast Decoupled Methods, Numerical problems.

Unit-2 Short Circuit Analysis

Symmetrical Fault Analysis: (6hrs)

Symmetrical fault analysis-Short circuit current and MVA calculations, Series reactors-Selection and Advantages of reactors, Numerical problems.

Unsymmetrical Fault Analysis: (7hrs)

Symmetrical component theory-Positive, Negative and Zero sequence components, Sequence impedances and networks, Various types of faults-LG, LL and LLG on unloaded alternator, Numerical problems.

Unit-3 Stability Analysis

Steady State Stability: (7hrs)

Classification of power system stability, Transfer Reactance, Synchronizing Power Coefficient ,Power Angle Curve , Determination of Steady State Stability, Methods to improve steady state stability, Numerical Problems.

Transient Stability: (6hrs)

Swing Equation, Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion-Critical Clearing Angle and time, Methods to improve transient stability, Numerical Problems.

Unit-4 Economic Operation of Power Systems:

Different Curves: (6hrs)

Optimal operation of Generators in Thermal power stations, Input–output characteristics, Cost Curve, Heat rate curve, Incremental fuel and Production costs.

Mathematical Analysis: (6hrs)

Optimum generation allocation with and without transmission line losses, Loss Coefficients, General transmission line loss formula, Numerical Problems.

Unit-5 Load Frequency Control

Load Frequency Control-I: (7hrs)

Modeling of speed governing system-steam turbine-generator, Control area concept, Single area control-Transfer function and Block diagram representation of an isolated power system, Steady state analysis, Dynamic response, Numerical Problems.

Load Frequency Control-II: (6hrs)

Proportional plus Integral control of single area and its block diagram representation, Two area control- Transfer function and Block diagram representation, Tie-line bias control.

Course Outcomes

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

CO1	Find out the load flow solution of a power system network using different load flow methods.
CO2	Evaluate the fault current for different types of faults with a view to provide data for the design of protective devices.
CO3	Analyze the steady state and transient stability concepts of a power system.
CO4	Calculate optimal scheduling for generators **with and without losses**.
CO5	Acquire the knowledge of load frequency control **for various systems**.

Text books:

1. Modern Power System Analysis- I.J.Nagrath&D.P.Kothari: Tata McGraw-Hill Publishing Company, 2nd edition.
2. Electrical Power Systems- C.L. Wadhwa, New Age International Publishers, 7th Edition.

Reference books:

1. Power System Analysis–Grainger and Stevenson, Tata McGraw-Hill
2. Power Systems Operation and Control –Chakravarthi, Prentice Hall, Inc.
3. Power System Analysis -Hadi Saadat, TMH Edition .
4. Power System Stability & Control -PrabhaKundur, TMH.

e- Resources & other digital material

1. https://nptel.ac.in/courses/117105140/
2. https://nptel.ac.in/courses/108/105/108105104
3. https://nptel.ac.in/courses/108/107/108107127/
4. https://nptel.ac.in/courses/108/105/108105060/
5. https://www.coursera.org/learn/electric-power-systems
6. https://www.edx.org/ power-systems
7. https://www.classcentral.com/course/electric-power-systems

III Year II Semester

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MACHINE LEARNING

PRE-REQUISITES: 1) Basic Statistics, 2) Data Mining

Course objectives: The student should be able to

1. Recognize the characteristics of machine learning, binary classification
2. Solve classification problems using multiclass classification and concept learning
3. Apply Tree based and Rule based learning models to real world problems
4. Apply Linear models and Distance based classification and clustering algorithms
5. Analyze Bayesian classifiers and Understand the concept behind neural networks for learning non-linear functions

Unit-1 The ingredients of machine learning, Tasks: (08 hrs)

The problems that can be solved with machine learning, Looking for structure, Evaluating performance on a task, **Models: the output of machine learning:** Geometric models, Probabilistic models, Logical models, Grouping and grading, **Features:** the workhorses of machine learning, Two uses of features, Feature construction and transformation.

Binary classification and related tasks: (06 hrs)

Classification, Assessing classification performance, Visualizing classification performance, Class probability estimation, Assessing Class probability estimates

Unit-2 Beyond binary classification: (07 hrs)

Handling more than two classes, Multi class classification Multi class scores and probabilities, Regression, Unsupervised and descriptive learning, Predictive and descriptive clustering.

Concept learning: (07 hrs)

The hypothesis space, Least general generalization, Internal disjunction ,Paths through the hypothesis space, Most general consistent hypotheses, Closed concepts, Beyond conjunctive concepts

Unit-3 Tree models: (06 hrs)

Decision trees, Ranking and probability estimation trees, Tree learning as variance reduction.

Rule models: (06 hrs)

Learning ordered rule lists, Learning unordered rule sets, Descriptive rule learning, First-order rule learning.

Unit-4 Linear models: (07 hrs)

The least-squares method, multivariate linear regression, regularized regression, using least-squares regression for classification, Support vector machines, Soft margin SVM.

Distance Based Models: (07 hrs)

Ways of measuring distance, Neighbours and exemplars, Nearest Neighbours classification, Distance based clustering, k means algorithm, Clustering around mediods, Silhouettes, Hierarchical Clustering.

Unit-5 Bayesian Learning: (06 hrs)

Introduction, Bayes Theorem, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, Learning to classify Text.

Artificial Neural Networks: (06 hrs)

Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks and the back propagation algorithm.

Course Outcomes

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

CO1 **Recognize** the characteristics of machine learning, binary classification **{Understand level, KL2} {Analyze level, KL4}**

CO2 **Solve** classification problems using multiclass classification and concept learning **{Evaluate level, KL5}**

CO3 **Apply** Tree based and Rule based learning models to real world problems **{Apply level, KL3}**

CO4 **Apply** Linear models and Distance based classification and clustering algorithms **{Apply level, KL3}**

CO5 **Analyze** Bayesian classifiers and **Understand** the concept behind neural networks for learning non-linear functions **{Understand level, KL2} {Analyze level, KL4}**

Text books:

1. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012.
2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
3. Chris Albon : Machine Learning with Python Cookbook , O'Reilly Media, Inc.2018.

Reference books:

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.
3. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer Series , 2nd edition.

e- Resources & other digital material

1. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012, https://www.cs.ubc.ca/~murphyk/MLbook/pml-intro-5nov11.pdf
2. Professor S. Sarkar , IIT Kharagpur "Introduction to machine learning", https://www.youtube.com/playlist?list=PLYihddLFCgYuWNL55Wg8ALkm6u8U7gps
3. Professor Carl Gustaf Jansson, KTH, Video Course on Machine Learning https://nptel.ac.in/noc/individual_course.php?id=noc19-cs35
4. Tom Mitchell, "Machine Learning", http://www.cs.cmu.edu/~tom/10701_sp11/lectures.shtml

III Year II Semester

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BIG DATA ANALYTICS

PRE-REQUISITES: 1) Java Programming, DBMS, Data Mining

Course objectives: The student should be able to

1. Understand the Data Mining Concepts and Big Data Introduction
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop Eco System
6. To study different types Case studies on the current research and applications of the Hadoop and big data in Smart Grids

Unit-1 Data Mining Concepts: (10 hrs)
Data Mining, KDD Process, Kinds of Patterns Can Be Mined, Applications of DM.
Data pre-processing:
Data Cleaning - Missing Values, Noisy Data, Data Cleaning as a Process;
Data Integration - Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Data Value Conflict Detection and Resolution; Data Reduction;
Data Transformation and Data Discretization, Overview of Data Mining Techniques.
Introduction to Big Data: (04 hrs)
Big Data-definition, Characteristics of Big Data (Volume, Variety, Velocity), Data in the Warehouse and Data in Hadoop, Why is Big Data Important? Patterns for Big Data Development, Examples of Big Data Analytics.
Unit-2 Introduction to Hadoop: (07 hrs)
Working with Big Data: Google File System, A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem, Hadoop Releases, Hadoop Installation Modes.
Hadoop Distributed File System: (07 hrs)
HDFS, Building Blocks of Hadoop (Name node, Data node, Secondary Name node, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

Unit-3 Map Reduce: **(12 hrs)**
Introduction, How MapReduce works? MR Execution Flow with an Example, Understanding Hadoop API for MapReduce Framework (Old and New), Components of MapReduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner; MR Program for Word Count.
Unit-4 Pig: **(07 hrs)**
Admiring the Pig Architecture, Installation and Running of Pig, Execution Types, Evaluating Local and Distributed Modes, Pig Latin Editors, Comparison with databases, Pig Latin, Functions, Data Processing Operators, Checking out the Pig Script Interfaces, Scripting with Pig Latin, Running Pig Programs.
Hive: **(05 hrs)**
Installing Hive, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data.
Unit-5 Big Data Analytics in Smart Grids: (16 hrs)
Smart Grid: Architectural Designs, Smart Grid Communications And Measurement Technology, Performance Analysis Tools For Smart Grid Design. **(11 hrs)**
Big Data for Smart Grid: Need of Data Analysis in Smart Grid, Building the Foundation for Data

Analytics, Applying Analytical Models in the Utility, Big Data Integration, Frameworks, and Databases, **(03 hrs)**

Big Data implementation in smart grid: the case of customer data analytics **(02 hrs)**

Course Outcomes

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

CO1 **Understand** the concepts of Data mining and Big Data Analytics, Analyze Hadoop Architecture **{Understand level, KL2} {Analyze level, KL4}**

CO2 **Master** the concepts of Hadoop Distributed File System.**{Apply level, KL3}**

CO3 **Acquire** knowledge on Map Reduce Framework. **{ Evaluate level, KL5}**

CO4 **Apply** Pig and Hive concepts for Data Processing. **{Evaluate level, KL5}**

CO5 **Analyze** the Data Analytics on Smart Grid. **{Analyze level, KL4}**

Text books:

1. Jiawei Han and Micheline Kamber, Data Mining Concepts & Techniques, 3 ed, Elsevier Publishers.
2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch , "Understanding Big Data Analytics for Enterprise Class Hadoop and StreamingData", 1st Edition, TMH,2012.
3. TomWhite, Hadoop,"TheDefinitiveGuide",3rdEdition,O'Reilly Publications, 2012.
4. Smart Grid: Fundamentals of Design and Analysis, 1st Edition, Wiley- IEEE Press.
5. Carol L. Stimmel, Big Data Analytics Strategies for the Smart Grid, CRC Press. 2015.
6. Daki, H., El Hannani, A., Aqqal, A. et al. Big Data management in smart grid: concepts, requirements and implementation. J Big Data 4, 13 (2017). https://doi.org/10.1186/s40537-017-0070-y.

Reference books:

1. Michael Berthold, DavidJ. Hand, "Intelligent Data Analysis", Springer, 2007.
2. David Loshin, "BigDataAnalytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann Publishers, 2013.
3. Hadoop in Practice by AlexHolmes, MANNING.
4. Hadoop in Action by ChuckLam, MANNING.

e- Resources & other digital material

1. https://onlinecourses.swayam2.ac.in/arp19_ap60/preview
2. Big Data Use cases for Beginners | Real Life Case Studies | Success Stories https://www.youtube.com/watch?v=HHR0-iJp2sM
3. Alexey Grishchenko, Hadoop vs MPP, https://0x0fff.com/hadoopvs-mpp/
4. Random notes on bigdata- SlideShare: www.slideshare.net/yiranpang/random-notes-on-big-data-26439474
5. https://nptel.ac.in/courses/106/104/106104189/
6. Prof. Nandansudharsanam and Prof . B.Ravindran , IIT Madras, Introduction to Data Analytics http://nptel.ac.in/courses/110106064/23

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III Year II Semester

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NANO TECHNOLOGY

PRE-REQUISITES:

1. Basic knowledge on materials.

Course objectives: The student should be able

1. To have the knowledge of fundamentals of nano technology.
2. To understand different structures of nano materials.
3. To study the structures of nano carbon, nano thermal and nano semiconductor materials.
4. To have a thorough knowledge of nano sensors.
5. To study the applications of nano technology in different engineering fields.

Unit-1 Introduction and classification (12 hrs)

Summary of electronic properties of atoms and solids, effects of Nano meter length scales, fabrication methods, preparation, safety and storage issues.

Unit-2 Nano Structures(12 hrs)

Importance of Nano-technology, Bottom-up and Top-down approaches, Zero Dimensional Nano-structures - Nano particles through homogenous nucleation and heterogeneous nucleation; One Dimensional Nano-structures - Nano wires and Nano rods, Spontaneous growth, Evaporation and condensation growth, Two dimensional Nano-structures - Fundamentals of film growth. Physical vapour Deposition (PVD) and Chemical Vapour Deposition (CVD):

Unit-3 Carbon Nano Structures(12 hrs)

DLCs, Fullerenes, C60, C80 SWNT and MWNT; Properties: Mechanical, Optical and Electrical properties.

Thermo Electric Materials

Concept of phonon, Thermal conductivity, Specific heat, Exothermic & Endothermic processes.

Nano Semiconductors: Nano scale electronic devices including CMOS, Potentiometric sensors etc., MRAM devices

Unit-4 Nano sensors(12 hrs)

Introduction to sensors. Characteristics and terminology - Fundamentals of sensors, Sensors for aerospace and defense. Organic and inorganic Nano sensors. Sensor for bio-medical applications, Bioelectronics, Nanoparticle-biomaterial hybrid systems for sensing applications. Gas sensor. Biosensors: Principles, DNA and nucleotide-based biosensors, Protein-based biosensors,

Unit-5 Application of Nanotechnology(12 hrs)

Consumer goods, Cosmetics, Nano catalyst, paints, food and agriculture industries, Nanotechnology for waste reduction and improved energy efficiency, nanotechnology based water treatment strategies. Nano-toxicology. Use of Nano-particles for environmental remediation and water treatment.

Course Outcomes

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

CO1 Know the fundamentals, properties and fabrication methods of Nano components

CO2 Know the structures of zero, one and two dimensional Nano components

CO3 Know the structures of carbon, thermal and semiconductor materials

CO4 Have the knowledge of Nano sensors and their applications

CO5 Apply the Nano technology in different engineering and other fields.

Text books:

1. Encyclopedia of Nanotechnology- Hari Singh Nalwa
2. Introduction to Nano technology by Charles P. Poole Jr and Frank J. Owens, Wiley-Inter science, 2003

Reference books

1. Springer Handbook of Nanotechnology - Bharat Bhusan
2. Handbook of Semiconductor Nanostructures and NanodevicesVol 1-5- A. A. Balandin, K. L.
   Wang.
3. Nanostructures and Nanomaterials - Synthesis, Properties and Applications - Cao, Guozhong.

III Year II Semester

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DIGITAL SIGNAL PROCESSING

PRE-REQUISITES: 1) Signals & Systems
2) Mathematics,
3) Concept of Communications

Course objectives: The student should be able to

1. Analyze the Discrete Time Signals and Systems
2. Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3. Learn the FIR and IIR Filter design procedures
4. Able to realize the digital filters with different structures
5. Know the need of Multirate Processing & Learn the concepts of DSP Processors

Unit-1 Introduction to Discrete Time Signals & Systems. (12 Hrs.)

Introduction to Digital Signal Processing, Discrete time Signals, Signal Processing, Discrete time Systems, Linear Shift Invariant Systems, Condition for Stability. Linear Constant Coefficient Difference Equations, Discrete Time Fourier Transformation and its Properties, Linear Convolution, Review of Z-Transforms –Solutions of Difference Equations using Z-Transforms, Stability Criteria in Z-Transform

Unit-2 DFT & FFT (14 Hrs.)

DFS, Properties of DFS, DFT, Properties of DFT, DFT as Linear Transformation, Circular Convolution, Sectional Convolution-Overlap Add and Overlap Save Methods , Linear Convolution using Circular Convolution.

Introduction to FFT, Efficient Computation of DFT, Radix-2 Algorithms- Decimation in Time and Decimation in Frequency Algorithms, Inverse DFT using FFT .

Unit-3 Design And Realization of IIR filters (12Hrs.)

Introduction to Digital Filters, Analog Filter Approximations-Butterworth &Chebyshev, Digital IIR Filters Design from Analog filters, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms

Unit-4 Design And Realization of FIR filters (14 Hrs.)

Introduction to FIR Filters, Characteristics of FIR Filters, Frequency Response, Design of FIR Filters-Fourier Series Method , Frequency Sampling method and Window Method. Basic structures of FIR systems, Lattice structures, Lattice-ladder structures.

Unit-5 Multirate Digital Signal Processing & Introduction to DSP processors (12 Hrs.)

Introduction, Down Sampling, Decimation, Spectrum of Down Sampling, Up Sampling, Interpolation, Spectrum of Up Sampling, Cascading Sample Rate Converters, Sampling Rate Conversion, Applications of Multirate DSP. **(6 Hrs.)**

Introduction to DSP processors, Basic architecture of TMS320 6713 DSP processor, Applications of DSP processors - Detection of QRS complex of ECG signals, Generation and detection of DTMF signals, Speech compression using Linear Predictive Coding. **(6 Hrs.)**

Course Outcomes

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

CO1 **Analyze** the Discrete Time Signals and Systems & Apply the difference equations concept in the analysis of Discrete time systems. **{Apply level, KL1,3}**

CO2 **Know** the importance of FFT algorithm for computation of Discrete Fourier Transform &**Use** the FFT algorithm for **solving** the DFT of a given signal**{Apply level, KL1,2}**

CO3 **Design** a Digital filter (FIR&IIR) from the given specifications **{Analyze level, KL6}**

CO4 **Realize** the digital filters. **{Evaluate level, KL5}**

CO5 **Compare** different types of Multirate Processing and **Understand**the concepts of DSP Processors. **{Apply level, KL1,4}**

Text books:

1 Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris

2 G.Manolakis,Pearson Education / PHI, 2007..

3 Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI Private Limited.

4 Digital Signal Processors – Architecture, Programming and Applications,, B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002

5 Digital Signal Processing – K Raja Rajeswari, I.K. International Publishing House

Reference books:

1 Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006.

2 Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007..

3 Digital Signal Processing – Ramesh babu, Sci Tech publications

4 Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006

III Year II Semester

L	T	P	C
3	0	0	3

MANAGERIAL ECONOMIC AND FINANCIAL ANALYSIS

PRE-REQUISITES: 1) Basic Sciences and Humanities

Course objectives: The student should be able to

1. To equip the students with the basic inputs of managerial economics and demand concepts.
2. To understand the concepts of production and cost for various business decision.
3. To understand the different types of market, market structures & pricing strategies and their applications in business decision making and to know the different forms of Business organization and the concept of Business Cycles.
4. To understand the fundamental of accounting and analysis of accounting statements for managerial decision making.
5. To understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit-1 Introduction to Managerial Economics and demand Analysis: 10 Hrs

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting.

Unit-2 Theory of Production and Cost Analysis: 13 Hrs

Production Function – Isoquant and Isocost, MRTS, Least Cost Combination of Inputs - Laws of Returns to scale - Internal and External Economies of Scale, Cost Analysis: Cost concepts, Cost & output relationship in short run & long run - Break-even Analysis (BEA)-Determination of Break-Even Point - Significance and limitations.

Unit-3 Introduction to Markets, Pricing Policies & Types of Business Organization and Business Cycles: 12 Hrs

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, and Internet Pricing: Flat Rate Pricing, Usage sensitive pricing and Priority Pricing. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – Business Cycles: Phases of Business Cycles.

Unit-4 Introduction to Financial Accounting & Analysis: 13 Hrs

Financial Accounting and analysis: Accounting –significance -- Book Keeping-Double entry system –Journal- Ledger- Trial Balance- Final Accounts with simple adjustments.

Financial Statement Analysis through ratios: Ratio-analysis of financial statement using different ratios (Liquidity -Profitability- Solvency -Activity ratios).

Unit-5 Capital and Capital Budgeting: 12 Hrs

Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).

Course Outcomes

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

CO1 To equipped with the knowledge of estimating the Demand and demand elasticities for a product.

CO2 The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs

CO3 To understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.

CO4 To prepare Financial Statements and the usage of various Accounting tools for analysis

CO5 To evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

Text books:

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011.
2. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011.
3. Prof. J.V. Prabhakara rao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

Reference books:

1. V. Maheswari : Managerial Economics, Sultan Chand.
2. Suma Damodaran : Managerial Economics, Oxford 2011.
3. Dr. B. Kuberudu and Dr. T. V. Ramana : Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.
4. Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja : Financial Accounting for Managers, Pearson.
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012.

e- Resources & other digital material

1. **www.managementstudyguide.com**
2. **www.tutorialspoint.com**
3. **www.lecturenotes.in**

III Year II Semester

L	T	P	C
0	0	3	1.5

MICROPROCESSORS AND MICROCONTROLLERS LAB

Preamble: Microprocessors and Microcontrollers laboratory course helps the students to develop their knowledge on processor architecture and the programming skills. This laboratory course provides hands-on experience to interface I/O devices, perform stepper motor rotation and writing assembly level language programs etc. The skills acquired through the experiments help the students to dotheir projects and enhance their knowledge on the latest trends and technologies.

Course objectives:

The main objectives are

1. To perform arithmetic, logical, string and port operations using 8086 emulator software.
2. To implement timer and serial data operations using 8051 microcontroller.
3. To interface 8255 and 8279 using 8086Objective.

List of Experiments: Any 10 of the following experiments are to be conducted

1. ARITHMETIC OPERATIONS
    a. Multi byte addition and subtraction, multiplication and division
    b. ASCII – addition and subtraction, multiplication and division.
2. LOGIC OPERATIONS
    a. Packed BCD to Unpacked BCD
    b. BCD to ASCII
    c. Find the number of elements in the array having “1” in their 5th position.
3. STRING OPERATIONS
    a. Change position of word in a given string
    b. Reverse the given string
    c. Insert a word into given string
    d. Remove a word from given string
    e. Find length of the string.
4. PORT OPERATIONS
    a. Read data from port 1 and increment it by 1 and transfer it to port 2.
    b. Transfer 1 to 10 continuously port 1.
5. TIMER IN DIFFERENT MODES USING 8051
    a. Produce 1khz square wave with 50% duty cycle using timer 0 in mode 0.
    b. Produce 1khz square wave with 50% duty cycle using timer 0 in mode 1
    c. Produce 1khz triangular wave with 50% duty cycle using timer 0 in mode 1
6. SERIAL DATA COMMUNICATION
    a. Receive data serially.
    b. Transfer “HELLO” serially at 9600 band, 8 bit data and 1 stop bit.
7. Addition & Subtraction using 8086 Kit
8. Interfacing 8279 – Keyboard Display.
9. Interfacing 8255–PPI
10. Stepper motor control using 8253/8255

List of Additional Experiments: Any 2 of the following experiments are to be conducted

1. Interfacing of 8259- Programmable Interrupt Controller
2. Traffic light control using 8051 micro controller
3. A/D and D/A converter using 8255.

Software(s)/ Hardware(s) used: EMU8086, 8255, 8259 and 8279 interfacing boards.

Course Outcomes

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

CO1 Understand and apply the fundamentals of assembly level programming of microprocessor.**{Knowledge level, KL1, KL3}**

CO2 Design and implement 8051 microcontroller based systems **{Knowledge level, KL1, KL2}**

CO3 Design interfacing circuits with 8086. **{Knowledge level, KL1, KL2}**

III Year II Semester

L	T	P	C
0	0	3	1.5

ELECTRICAL MEASUREMENTS &INSTRUMENTATION LAB

Pre-Requisites: 1) Basic Circuit Analysis

Course objectives:

1. To know various methods to calibrate the instruments
2. To know various methods for measurments of electrical parametes
3. To select the suitable instrurments for measurements

List of Experiments: Any 10 of the following experiments are to be conducted

1. Calibration of Electrodynamometer wattmeter UPF by phontom loading
2. Calibration of Electrodynamometer wattmeter LPF by direcet loading
3. Calibration of 3-Ph two element Electrodynamometer wattmeter UPF by direct loading
4. Calibration of electrodynamometer type Power factor meter
5. Calibration of 1-Ph induction type energy meter by direct loading
6. Measurement of Inductance by Andersons bridge
7. Measurement of capacitance by Schering bridge
8. Measurement of voltage by DC Cromptons potentiometer
9. Measurement of 3-Ph reactive power using single phase wattmeter for balanced load
10. Measurement of strain using resistance strain gauge
11. Characteristics of LVDT.
12. Dielectric oil testing using H.T test kit.

1.

List of Additional Experiments: Any 2 of the following experiments are to be conducted

1. Measurement of 1-phase power using 3-voltmeter and 3-ammeter method.
2. Estimation of iron losses from B-H curve using CRO.
3. Dielectric oil testing using H.T test kit.
4. Determination of transformer ration and phase angle error using current transformer.

Course Outcomes:

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

CO1 Calibrate various electrical measuring instruments{Analyzing level, KL4}

CO2 Measure various electrical parameters{Apply level, KL3}

CO3 Choose suitable instrument for given measurement{Evaluating level, KL5}

Text books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney, Dhanpat Rai & Co 17th edition 2000.
2. Electronic Instrumentation by H S Kalsi, 2nd Edition, McGraw-Hill Publishing, 2004.
3. Electrical Measurements and measuring Instruments - by E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing, 1999.

e- Resources & other digital material

1. https://sl-coep.vlabs.ac.in/LinearVariableDifferntialTransformer/Theory.html?domain=Electrical%20Engineering&lab=Welcome%20to%20Sensor%20Lab!
2. http://vlabs.iitkgp.ernet.in/asnm/exp23/index.html
3. http://vlabs.iitkgp.ernet.in/asnm/exp21/index.html

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IV Year I Semester

L	T	P	C
3	0	0	3

Management Science

Prerequisites: Basic Sciences and Humanities

Course Objective:

1. To familiarize with the process of management, principles, and basic concepts of Organization.
2. To understand the tools of operations and Materials Management.
3. To provide conceptual knowledge on functional management like Human resource management and Marketing management.
4. To impart knowledge on project management.
5. To provide basic insight into selected contemporary management practices and Strategic Management.

Course Outcomes:

After completion the Course, Student will be able to:

CO 1: Apply management and motivation theories to renovate the practice of management.

CO 2: Explain concepts of quality management and use process control charts, concepts and tools of quality engineering in the design of products and process controls.

CO 3: Appraise the functional management challenges associated with high levels of change in the organizations.

CO 4: Identify activities with their interdependency and use scheduling techniques of project management PERT/CPM.

CO 5: Develop global vision and management skills both at strategic level and interpersonal level.

UNIT – I Introduction to Management: **12 Hrs**

Concept –nature and importance of Management –Generic Functions of Management – Principles and Types of Management –Evolution of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization – Organizational typology.

UNIT - II Operations Management: **12 Hrs**

Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C-chart) Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis), Justin- Time (JIT) system, Total Quality Management (TQM), Six sigma, Supply chain management.

UNIT – III Functional Management: **12 Hrs**

Concept of HRM, HRD and ER (Employee Relations) - Functions of HR Manager- Compensation Management plans – Job Evaluation and Merit Rating - Marketing Management: Functions of Marketing – Marketing strategies based on product Life Cycle, Channels of distributions.

UNIT – IV Project Management: **12 Hrs**

(PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).

UNIT - V Strategic Management: **12 Hrs**

Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy Alternatives, Basic concepts of MIS, ERP, Capability Maturity Model(CMM) Levels, Balanced Score Card.

Text Books:

1. Management Science, Aryasri, Tata McGraw Hill, 2014.
2. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Introduction to *Management Science'* Cengage, Delhi, 2012.
3. G Srinivasa Rao: 'Management Science', The Hi-Tech Publishers, 2004.

Reference Books:

1. Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshan ul Haque , 17th Edition, Pearson Education/ Prentice Hall of India, 2018.
2. Human Resource Management: Gary Dessler, 14th Edition, pearson 2015.
3. Production and Operations Management: S N Chary, TMH, 2019, 6e.
4. Project Planning and Control with PERT and CPM: Dr. B. C. Punmia, K. K Khandelwal, Laxmi Publication, 2017, 4th Edition.
5. Strategic Management: John A Pearce, Richard B Robinson, TMH 12th Edition, 2017.

Web links:

4. www.managementstudyguide.com
5. www.tutorialspoint.com
6. www.lecturenotes.in

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IV Year I Semester

L	T	P	C
3	0	0	3

Switchgear and Protection

PRE-REQUISITES: 1) Power Systems

Course objectives: The student should be able to

1. Study the basic aspects of protection system and operation of circuit breakers.
2. Study the classification, operation and application of different types ofelectro magnetic protective relays.
3. Learn about the various protection schemes generators and transformers.
4. Know the various protection schemes applied for transmission lines and neutral grounding
5. Study the reasons for Over voltages, protection schemes and latest trends in Protection schemes

Unit-1 Introduction to Power system protection(12 hrs)

Power system protection: Faults in power system, characteristics of short circuit and open circuit faults and harmful effects, necessity of protection system, basic requirements, classification, protection system terminology. **(02 hrs)**

Fuse: Introduction to fuse, fuse materials, characteristics of fuse and ratings; HRC fuse**(02 hrs)**

Circuit Breakers: Elementary principles of arc phenomenon -Principle of operation of air, oil, vacuum and SF6 circuit breakers (Elementary treatment only) - Specification of circuit breakers, ratings and auto re-closures**. (08 hrs)**

Unit-2 Fundamentals of Protective relays(12 hrs)

Protective Relays: Relay connection – Principle of operation Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation –PSM, TSM - Relays classification– Instantaneous– DMT and IDMT types **(06 hrs)**

Applications of relays: Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation–Distance relays: Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison
(06 hrs)

Unit-3 Protection of AC generators and Transformer(12 hrs)

Protection of AC generators: Protection of generators against stator faults– Rotor faults and abnormal conditions–restricted earth fault and inter turn fault protection– Numerical example**. (07 hrs)**

Protection of transformers: Percentage differential protection– Design of CT's ratio–Buchholz relay protection–Numerical examples. **(05 hrs)**

Unit-4 Protection of Transmission lines and Neutral grounding(12 hrs)

Protection of lines: Over current Protection schemes - Numerical examples – **Pilot wire protection** - Carrier current and three zone distance relay using impedance relays–Protection of bus bars by using Differential protection.**(08 hrs)**

Neutral grounding: Grounded and ungrounded neutral systems–Effects of ungrounded neutral on system performance– Methods of neutral
grounding: Solid–resistance–Reactance–Arcing grounds and grounding Practices **(04 hrs)**

Unit-5 Protection against Over voltages and Advancements in Protection systems (12 hrs)

Over Voltage Protection: Causes of over voltages in power systems – internal causes - Protection

against lightning over voltages: Rod gap and horn gap arrester–Valve type and expulsion type lighting arresters and ground wires (elementary treatment only) – Selection of lightning arresters - Insulation coordination **(10 hrs)**

Advancements in Protection systems: Advancements in protective relays: Static relays, digital relays block diagram - Preliminaries of Synchro Phasor, Phasor measuring units, Wide Area Monitoring **(02 hrs)**

Course Outcomes

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

- **CO1** **Acquire** the knowledge of protection systems and operation of circuit breakers **{Understand level, KL2}**
- **CO2** **Describe** the operating principles of various types of relays.**{ Understand level, KL2}**
- **CO3** **Select** appropriate protection scheme for AC generator and transformer **{Apply level, KL3}**
- **CO4** **Choose** appropriate protection scheme for transmission lines and **know** about different neutral grounding techniques**{ Apply level, KL3}**
- **CO5** **Understand** the reasons behind over voltages and operation of lightning arrester along with latest trends in protection system**{ Understand level, KL2}**

Text books:

1.A text book on Power System Engineering by M.L. Soni, P.V.Gupta, U.S. Bhatnagar and A. Chakrabarti, DhanpatRai& Co Pvt. Ltd.

2.Electrical power systems by C.L.Wadhwa, New Age International (P) Ltd, Publishers, 1998.

Reference books:

1.Fundamentals of Power System Protection by Paithankar Y.G and Bhide S.R. PHI, 2007

2.Switchgear and protection by Sunil S. Rao Khanna Publications.

3.Switchgear and Protection by J.B.Gupta, S.K.Kataria and sons .Publications, 2nd edition, 2004

4.Power System Protection and Switchgear by B.Ram and D.N.Viswakarma, Tata McGraw Hill, 2ndEdition, 2011

5.A. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley &Sons, 1988

e- Resources & other digital material

1.https://nptel.ac.in/courses/108101039

2.https://nptel.ac.in/courses/108105167

3.https://nptel.ac.in/courses/108107167

4.https://nptel.ac.in/courses/117107148

5.https://www.youtube.com/playlist?list=PLBVJZMfxcrJn3p03lxsOP_ivHXzFLysYE

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IV Year I Semester

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FACTS

PRE-REQUISITES: 1) Power Electronics and Power Systems

Course Objectives: The student should be able to

1. Study the basics of power flow control in transmission lines using FACTS controllers
2. Explain operation and control of voltage source and current source converter.
3. Understand Shunt compensation methods to improve stability and reduce power oscillations of a power system.
4. Know the methods of compensation using Series compensators.
5. Study the operation and control of Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC).

Unit-1 Introduction to FACTS and High Power Electronic Devices(12 hrs)

Introduction to FACTS (08 hrs)

Power flow in an AC System – Loading capability limits – Dynamic stability considerations – Importance of controllable parameters – Basic types of FACTS controllers – Benefits from FACTS controllers.

Introduction to High Power Electronic Devices(04 hrs)

Requirements and characteristics of high power devices – Voltage and current rating – Losses and speed of switching – Parameter trade–off devices.

Unit-2 Voltage source and Current source converters (12 hrs)

Voltage source converters: Concept of voltage source converter (VSC) – Single phase bridge converter – Square wave voltage harmonics for a single–phase bridge converter – Three–phase full wave bridge converter. **(09 hrs)**

Current source converters– Concept of current source converter(CSC) -Comparison of current source converter with voltage source converter. **(03 hrs)**

Unit-3 Shunt Compensators (14 hrs)

Shunt Compensators–1 (07 hrs)

Objectives of shunt compensation – Mid–point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – improvement of transient stability – Power oscillation damping.

Shunt Compensators–2 (07 hrs)

Thyristor Switched Capacitor (TSC) – Thyristor Switched Reactor (TSC–TCR) - Static VAR compensator (SVC) and Static Compensator (STATCOM)- comparisons between SVC and STATCOM.

Unit-4 Series Compensators (12 hrs)

Static series compensators**:** Concept of series capacitive compensation – Improvement of transient stability – Power oscillation damping – Functional requirements. GTO thyristor controlled Series Capacitor (GSC) – Thyristor Switched Series Capacitor (TSSC), Thyristor Controlled Series Capacitor (TCSC) and Static Synchronous Series Compensator (SSSC)

Unit-5 Combined Controllers (10 hrs)

Schematic and basic operating principles of Unified Power Flow Controller (UPFC) and Interline Power Flow Controller(IPFC),real time applications of these controllers on transmission lines.

Course Outcomes

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

CO1 **Understand** the power flow control in transmission lines using FACTS controllers. **{Understand level, KL2}**

CO2 **Explain** the operation and control of voltage source and current source converters. .**{Apply level, KL3}**

CO3 **Analyze** the compensation methods to improve stability and reduce power oscillations in the transmission lines.**{Analyze level, KL4}**

CO4 **Understand**the methods of compensations using series compensators. . **{Understand level, KL2}**

CO5 **Explain** operation and control of Unified Power Flow Controller (UPFC) and Interline Power Flow Controller(IPFC).**{Apply level, KL3}**

Text books:

1. "Understanding FACTS" N.G.Hingorani and L.Guygi, IEEE Press.Indian Edition is available:— Standard Publications, 2001.

Reference books:

1 "Flexible AC transmission system (FACTS)" Edited by YONG HUE SONG and ALLAN T JOHNS, Institution of Electrical Engineers, London.

2 Flexible AC Transmission Systems: Modeling and Control by Zhang Rehtanz Bikash Pal, SPRINGER INDIA.

3 Facts Controllers In Power Transmission and Distribution by K.R.Padiyar, New Age International Pvt Ltd; Second edition (1 January 2016)

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/102/108102047/
2. https://www.coursera.org/learn/electric-power-systems
3. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=00634216
4. https://www.electronicshub.org/flexible-ac-transmission-systemfacts/
5. https://www.electrical4u.com/facts-on-facts-theory-and-applications/
6. https://link.springer.com/book/10.1007%2F978-3-642-28241-6

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IV Year I Semester

L	T	P	C
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Cyber Security

PRE-REQUISITES: NIL

Course objectives: The student should be able

1. To familiarize various types of cyber-attacks and cyber-crimes.
2. To give an overview of the cyber laws and cyber forensic.
3. To study the defensive techniques against these attack in mobile and wireless devices.
4. To understand the security and privacy implications in organization.
5. To know the data privacy issues.

Unit-1 Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Unit-2 Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics.

Unit-3 Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit-4 Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Unit-5 Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Course Outcomes

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

CO1 To understand cyber-attacks.
CO2 To know the cyber laws and cyber forensic.
CO3 To protect them self and ultimately the entire Internet community from such attacks.
CO4 To understand the security and privacy implications in organization.
CO5 To know the data privacy issues.

Text books:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Reference books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group

e- Resources & other digital material

1. **https://onlinecourses.swayam2.ac.in/nou19_cs08/preview**

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IV Year I Semester

L	T	P	C
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Electric Drives

PRE-REQUISITES:

1) Power Electronics

2) Electric motors

Course objectives: The student should be able to

1. To learn the fundamentals of electric drive and different electric braking methods.
2. To analyze the operation of single phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
3. To understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
4. To learn the principles of static rotor resistance control and various slip power recovery schemes.
5. To understand the speed control mechanism of synchronous motors

Unit-1 Fundamentals of Electric Drives

Electric drive – Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods**:** Dynamic – Plugging – Regenerative methods.

Unit-2 Controlled Converter Fed DC Motor Drives

1-phase half and fully controlled converter fed separately and self-excited DC motor drive –Output voltage and current waveforms – Speed-torque expressions – Speed-torque characteristics — Principle of operation of dual converters and dual converter fed DC motor drives -Numerical problems.

Unit-3 DC–DC Converters Fed DC Motor Drives

Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous current operation– Output voltage and current waveforms – Speed–torque expressions – Speed–torque characteristics –Four quadrant operation – Closed loop operation (qualitative treatment only).

Unit-4 Stator side control of 3-phase Induction motor Drive

Stator voltage control using 3-phase AC voltage regulators – Waveforms –Speed torque characteristics– Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter – Closed loop v/f control of induction motor drives (qualitative treatment only).

Rotor side control of 3-phase Induction motor Drive

Static rotor resistance control – Slip power recovery schemes – Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics – Advantages –Applications.

Unit-5 Control of Synchronous Motor Drives

Separate control & self-control of synchronous motors – Operation of self-controlled synchronous motors by VSI– Closed Loop control operation of synchronous motor drives (qualitative treatment only).–Variable frequency control–Pulse width modulation.

Course Outcomes

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

CO1 **Understand** the fundamentals of electric drive and different electric braking methods.

CO2 **Analyze** the operation of three phase converter fed dc motors and four quadrant operations of dc

motors using dual converters.

CO3 **Describe** the converter control of dc motors in various quadrants of operation

CO4 **Know** the concept of speed control of induction motor by using AC voltage controllers and Differentiate the stator side control and rotor side control of three phase induction motor.

CO5 **Explain** the speed control mechanism of synchronous motors

Text books:

1. Fundamentals of Electric Drives – by G K DubeyNarosa Publications
2. Power Semiconductor Drives, by S.B.Dewan, G.R.Slemon, A.Straughen, Wiley-India Edition.

Reference books:

1. Electric Motors and Drives Fundamentals, Types and Apllications, by Austin Hughes and Bill Drury, Newnes.
2. Thyristor Control of Electric drives – VedamSubramanyam Tata McGraw Hill Publications.
3. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI
4. Power Electronics handbook by Muhammad H.Rashid, Elsevier.

e- Resources & other digital material

1. Four Quadrant Operation of DC Motor – Motoring and Breaking Operation (tutorialspoint.com)
2. Chopper Control of DC Motors: Operation and Set-Up | Electrical Engineering (engineeringenotes.com)

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IV Year I Semester

L	T	P	C
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Power System Reliability

PRE-REQUISITES:

1) Power Systems- I
2) Power Systems- II
3) Probability and Stochastic Methods

Course objectives: The student should be able to

1. Study various methods and measure for determining reliability of a system
2. Compute failure frequencies and duration for components failure.
3. Study models for reliability determination and identify probable failures in electrical generation system.
4. Compute outage and identify contingency in power transmission system
5. Identify the reliability models for radial distribution system

Unit-1 Network Modelling and Reliability Analysis (12 hrs)

Reliability concepts – exponential distributions – meantime to failure – series and parallel system – MARKOV process – recursive technique - Bathtub curve **(07 hrs)**

Reliability Measures MTTF, MTTR, MTBF**(05 hrs)**

Unit-2 Frequency & Duration Techniques(12 hrs)

Frequency and duration concept – Evaluation of frequency of encountering state, mean cycle time for one and two component repairable models **(06 hrs)**

evaluation of cumulative probability and cumulative frequency of encountering of merged states**(06 hrs)**

Unit-3 Generation System Reliability Analysis(12 hrs)

Reliability model of a generation system: recursive relation for unit addition and removal – load modelling - Merging of generation load model **(07 hrs)**

evaluation of transition rates for merged state model – cumulative Probability, cumulative frequency of failure evaluation – LOLP, LOLE**(05 hrs)**

Unit-4 Transmission System Reliability Analysis(12 hrs)

Deterministic contingency analysis-Determination of reliability indices like LOLP and expected value of demand not served.

Unit-5 Distribution System Reliability Analysis(12 hrs)

Basic Concepts – Additional interruption indices - Evaluation of Basic and performance reliability indices of radial networks.

Course Outcomes

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

CO1	**Demonstrate** basic reliability measures**{Understand level, KL2}**
CO2	**Apply** failure frequency and duration for power system applications **{Apply level, KL3}**
CO3	**Analyze** the failure probability of generation system **{Analyze level, KL4}**
CO4	**Analyze** the outage and contingency of transmission system. **{Analyze level, KL4}**

CO5 **Analyze** the reliability of radial distribution networks. **{Analyze level, KL4}**

Text books:

1.R. Billinton, R.N.Allan, “Reliability Evaluation of Power systems” second edition, Springer.

2.Charles E. Ebeling, “An Introduction to Reliability and Maintainability Engineering”, TATA Mc Graw - Hill – Edition.

Reference books:

1.R. Billinton, R.N.Allan, “Reliability Evaluation of Engineering System”, Plenum Press, New York.

2.Eodrenyi, J., “Reliability modelling in Electric Power System”, John Wiley, (1980)

e- Resources & other digital material

1. https://ieeexplore.ieee.org/abstract/document/8614407
2. https://www.sciencedirect.com/science/article/abs/pii/095183209090007A
3. https://ekeeda.com/degree-courses/electrical-engineering/power-system-planning-and-reliability
4. https://www.intechopen.com/chapters/57936

IV Year I Semester

L	T	P	C
3	0	0	3

Programmable Logic Controller

Course objectives: The student should be able to

1. To have knowledge on PLC.
2. To acquire the knowledge on programming of PLC.
3. To understand different PLC registers and their description.
4. To have knowledge on data handling functions of PLC.
5. To know how to handle analog signal and converting of A/D in PLC.

Unit-1 INTRODUCTION (5 hrs)

PLC Basics: PLC systems, I/O modules and interfacing, CPU processor, programming equipment, programming formats, constraints of PLC ladder diagrams, devices connect modules.**(05 hrs)**

Unit-2 PLC Programming(7 hrs)

PLC Programming: Input instructions ,output operations procedures, programming using contacts and coils. Digital logic gates, programming in the Boolean algebra conversion example, ladder diagram and sequence listings, ladder diagram**(07 hrs)**

Unit-3 Programmable Timers and Counters (6hrs)

Timer Instructions ,on delay time instruction, off delay timer instruction, counter instructions, Up counter, Down counter, Cascading counters, Incremental Counter applications, Combing counter and timer functions.

Unit-4 Program Control Instructions & Other Instructions (8hrs)

Master control reset instruction, Jump instructions and sub routines, Immediately instructions. Data manipulation, Data transfer operation, Data compare instruction, Data programs, Numerical data I/O interfaces, Math instructions, Addition, Subtraction and division instruction, Sequential instructions, Sequence programs, Shift Registers.

Unit-5 Applications (4hrs)

Control of water level indicator, Alarm monitor, Conveyor motor control, Ladder diagram for process control, PID Controller.

Course Outcomes

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

CO1	**Understand** the PLC's and their I/O modules**{Understand level, KL2}**
CO2	**Explain** Develop control algorithms to PLC using ladder logic**{Apply level, KL3}**
CO3	**Analyze** Manage PLC registers for effective utilization in different applications. **{Analyze level, KL4}**
CO4	**Evaluate** Design PID controller with PLC**{Evaluate level, KL5}**

Text books:

1. Programmable logic controller by Frank D.Petruzella-McGraw Hill-3rd Edition
2. Programmable logic controller –Principle and applications by John w.Web Reiss ,fifth edition, PHI.

Reference books:

1. Programmable logic controllers-Programming method and applications by and F.D Hackworth Jr. Pearson,2004.
2. Introduction to Programmable logic controllers-Gary Dunning.
3. Programmable logic controllers-W.Bolton _Elsevier Publisher.

IV Year I Semester

L	T	P	C
3	0	0	3

Reactive power compensation and Management

PRE-REQUISITES: 1) Power Systems-II

Course objectives: The student should be able to

1. Identify the necessity of reactive power compensation.
2. Describe load compensation.
3. Select various types of reactive power compensation in transmission systems
4. Contrast reactive power coordination system.
5. Characterize distribution side and utility side reactive power management.

Unit-1 Load Compensation(11 hrs)

Load Compensation: Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.

Unit-2 Steady – State Reactive Power Compensation in Transmission System(13 hrs)

Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation –examples Transient state reactive power compensation in transmission systems: Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation – compensation using synchronous condensers – examples

Unit-3 Reactive Power Coordination(12 hrs)

Objective – Mathematical modelling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences.

Unit-4 Demand Side Management(12 hrs)

Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels Distribution side Reactive power Management: System losses – loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks.

Unit-5 User Side Reactive Power Management(12 hrs)

KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations Reactive power management in electric traction systems and are furnaces: Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations-furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace

Content Beyond the syllabus: Reactive power control in Microgrid: Basic understanding of Microgrid, Reactive power control of grid connected microgrid. (Elementary treatment only).

Course Outcomes

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

CO1	**Distinguish** the importance of load compensation in symmetrical as well as un symmetrical loads**{Distinguish level, KL4}**
CO2	**Observe** various compensation methods in transmission lines. **{Observe level, KL2}**

CO3 **Construct** model for reactive power coordination**{Construct level, KL6}**

CO4 **Understand** Different load patterns, Different methods of load shaping, Various loss reduction methods **{Understand level, KL2}**

CO5 **Distinguish** demand side reactive power management & user side reactive power management. **{Distinguish level, KL4}**

Text books:

1. Reactive power control in Electric power systems by T.J.E. Miller, John Wiley and sons, 1982.
2. Reactive power Management by D. M. Tagare, Tata McGraw Hill, 2004.

Reference books:

1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just "Reactive Power Compensation: A Practical Guide, April, 2012, Wiely publication.

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IV Year I Semester

L	T	P	C
0	0	3	1.5

Power Systems Laboratory

PRE-REQUISITES:

1. Power generation, Transmission and Protection
2. Power System Analysis

Preamble: To impart the practical knowledge of functioning of various power system components and determination of various parameters and simulation of load flows, transient stability, LFC and Economic dispatch.

Course Objectives: The student should be able to

1. To control the speed of three phase induction motors.
2. To determine /predetermine the performance of three phase induction.
3. To determine /predetermine the performance of single-phase induction.
4. To improve the power factor of single-phase induction motor.
5. To predetermine the regulation of three–phase alternator by various methods, find Xd/ Xq ratio of alternator and asses the performance of three–phase synchronous motor.

LIST OF EXPERIMENTS

Any Ten of the following experiments are to be conducted:

1. Sequence impedances of 3-phase transformer
2. Sequence impedances of 3-phase alternator by fault analysis
3. Calibration of Tong tester
4. ABCD parameters of transmission network
5. Load flow study using Gauss-Seidel method
6. Load flow study using Newton-Raphson method
7. Economic load dispatchwithout transmission losses
8. Economic load dispatchwith transmission losses
9. Load frequency control of single area system without controller
10. Load frequency control of single area system with controller
11. Load frequency control of two area system without controller
12. Load frequency control of two area system without controller

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

CO1 Able to understand affect of various faults in various power system components.

CO2 Students can execute energy management systems functions at load

CO3 Able to determine the parameters of various power system components

CO4 Able to understand the power flows and stability in power system.

Textbooks:

1. Nagrath I J and Kothari D P , “Modern Power System analysis” Tata McGraw Hill
2. Wadhwa C L “Electrical Power Systems” New Age International
3. Badri Ram and Vishwakarma D N “Power System Protection and Switch Gear” Tata McGraw Hill. 4. Ned Mohan, First Course in Power Systems, Wiley.

Reference books:

1. 1.Power System by V. K. Mehta.
2. 2.“Power systems and analysis” by Hadisaadat, Tata McGraw Hill

e- Resources & other digital material

1.https://nptel.ac.in/courses/108/105/108105017
2.https://nptel.ac.in/courses/103/102/108102146
3.www.nptelvideos.in/2012/11/electrical-power systems-i.html
*4.*https://www.electrical4u.com/power systems

IV Year I Semester

L	T	P	C
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Big Data Analytics Laboratory

PRE-REQUISITES: 1) Operating Systems: Linux commands, Windows
2) Programming Knowledge in JAVA

Preamble:

Big Data Analytics Lab provides the essential facilities to the students to augment their concepts about the fundamentals of Data structures implementation using java , Collections frame work, Set interface and various operations on Big Data analytics. This lab is mainly deals with the various Big data applications using various analytical tools like Pig and Hive. The lab covers the concepts of Basic file management commands in Hadoop environment, word count program using Map Reduce, pig Latin Scripts, operations on Tables using Hive.

Course Objectives: The student should be able to

1. To understand the implementation of various data structures using the Java.
2. To introduce the terminology, technology and its applications.
3. To determine concepts of analytics for business.
4. To apply analytics on structured data.

LIST OF EXPERIMENTS

Any Seven of the following experiments are to be conducted:

1. Implementation of Stack Data Structure using JAVA
    a. Simple Stack implementation
    b. Using Arrays
3. Implementation of Queue Data Structure using JAVA
4. Implementation of Linked List using JAVA
5. Implementation of Collection framework, Set interface in JAVA
6. Installation of HADOOP
    a. CDH (Cloudera Distributed Hadoop) Installation & Configuration on Virtual Box
    b. In LINUX Environment
7. File Management Tasks in HDFS
8. Implementation of word count programs using Map Reduce programming to process the stored data in HDFS.
9. Install & Run Pig then write pig Latin scripts to sort, group, join, project and filter your data.
10. Install & Run Hive then use Hive to create, alter and drop data bases, tables, views.

List of Additional Experiments: Any of the two experiments are to be conducted

1. Mining of Weather data using map Reduce concept by sensors. The dataset can be taken from National Climate Data Center (NCDC, http://www.ncdc.noaa.gov/).

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

Course Outcomes

CO1 **Applying Java concepts required for developing MapReduce programs.** (**Apply**)

CO2 Able to understand the fundamental concepts of Big Data & Hadoop framework. (**Understand and Apply**)

CO3 **Demonstrate** the knowledge of big data analytics and implement different file management task in Hadoop. (**Apply**)

CO4 **Analyze** and perform different operations on data using Pig Latin scripts. (**Understand, Apply and Analyze**).

CO5 **Illustrate** and apply different operations on relations and databases using Hive. (**Understand, Apply and Analyze**).

Text books:

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC.

2. Hadoop: the definitive guide by Tom white ,fourth edition O'reilly media 2015

3. Hadoop in Action by Chuck Lam, MANNING Publ.

Reference books:

1. Hadoop in Practice by Alex Holmes, MANNING Publ.

2. Hadoop MapReduce Cook Book, Srinath Perera, Thilina Gunarathne

e- Resources & other digital material

1. https://drive.google.com/drive/folders/0B8_ZAVB1cH_FOGh3VXltWVpPOFE?usp=sharing
2. https://freevideolectures.com/course/4233/nptel-big-data-computing/3
3. https://archive.nptel.ac.in/courses/106/104/106104189/

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IV Year II Semester

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Digital Control Systems

PRE-REQUISITES: 1) Control Systems

Course objectives: The student should be able to

1. To understand the concepts of digital control systems and assemble various components associated with it. Advantages compared to the analog type.
2. The theory of z–transformations and application for the mathematical analysis of digital control systems.
3. To represent the discrete–time systems in state–space model and evaluation of state transition matrix, the design of state feedback control by "the pole placement method."
4. To examine the stability of the system using different tests.
5. To study the conventional method of analyzing digital control systems in the w–plane.

Unit-1 Introduction and signal processing (06 hrs)

Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Continuous and Discrete Time Signals – Sample and hold devices –Frequency domain characteristics of zero order hold.

Unit-2 z–transformations (12 hrs)

Z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.

Unit-3 Stability analysis (10 hrs)

Mappingbetweenthes–Planeandthez–Plane–PrimarystripsandComplementarystrips–Stabilitycriterion – Modified Routh's stability criterion and Jury's stability test.

Unit-4 StatespaceanalysisandtheconceptsofControllabilityandObservability (06 hrs)

Statespacerepresentationofdiscretetimesystems–SolvingDiscreteTimestatespaceequations – State transition matrix and its properties– Discretization of continuous time state equations –Concepts of controllability and observability–Tests (without proof).

State Feedback Controllers and State Observers **(06 hrs)**

Design of state feedback controller through pole placement–Necessary and sufficient conditions – Ackerman's formula

Unit-5 Design of discrete–time control systems by conventional methods (08 hrs)

Transientandsteadystatespecifications–Designusingfrequencyresponseinthew–planefor lag and lead compensators–Root locus technique in the z–plane.

Content Beyond the syllabus: Design of state observers (Full Order and Reduced Order).

Course Outcomes

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

CO1	Understand the advantages of discrete time control systems and the "knowhow" of various associated accessories.**{understand level, kL2}**
CO2	Apply z–transformations and their role in the mathematical analysis of different systems(like Laplace transforms in analog systems).**{Apply level, KL3}**
CO3	Analyze thestabilitycriterionfordigitalsystemsandmethodsadoptedfortestingthesameare

explained.**{analyze level, kL4}**

CO4 Evaluating the conventional and state space methods of design. **{evaluate level, kL5}**

CO5 Applying the design procedure in the w-plane. **{Apply level, KL4}**

Text books:

1. Discrete–Time Control systems–K. Ogata,PearsonEducation/PHI, 2ndEdition.
2. DigitalControlandStateVariableMethodsbyM.Gopal,TMH,4th Edition.

Reference books:

1. Digital Control Systems, Kuo, Oxford University Press, 2ndEdition,2003.
2. Digital Control Systems Analysis and Design- 3rd edition- Charles S Phillips, H.Troy Nagle - PHI

e- Resources & other digital material

1. https://nptel.ac.in/courses/108103008

IV Year II Semester

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3	0	0	3

Electric Vehicles

PRE-REQUISITES:

i. **Electric machines**
ii. **Power Electronics**

Course objectives: The students should be able to

1. To get exposed to EV system configuration and parameter
2. To know about electro mobility and environmental issues of EV
3. To understand about basic EV propulsion and dynamics
4. To understand about fuel cell technologies for EV
5. To know about basic battery charging and control strategies used in electric vehicles

Unit-1 Introduction to EV Systems and Parameters

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters. **(10 hrs)**

Unit-2 EV and Energy Sources

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems**(10 hrs)**

Unit-3 EV Propulsion and Dynamics

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi-motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration**(12 hrs)**

Unit-4 Fuel cells

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle. Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples. **(10 hrs)**

Unit-5 Battery Charging and control

Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modelling of electro mechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle. **(12 hrs)**

Content Beyond the syllabus:

- Impact of different transportation technologies on environment and energy supply.
- Electric drives used in HEV/EVs

Course Outcomes

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

CO1 **Understand**about various configurations in parameters of EV systems **{Understand level, KL2}**

CO2 **Understand** about electro mobility and environmental issues of EVs**{ Understand level, KL2}**

CO3 **Analyze**about propulsion and dynamic aspects of EV **{Analyze level, KL4}**

CO4 **Understand** fuel cell technologies in EV systems. **{ Understand level, KL2}**

CO5 **Analyze**about battery charging and controls required of EVs **{Apply level, KL4}**

Text books:

1. C.C Chan, K.T Chau: "Modern Electric Vehicle Technology", Oxford University Press Inc., New York 2001.
2. James Larminie, John Lowry, "Electric Vehicle Technology Explained", Wiley, 2003.

Reference books:

1. Iqbal Husain,, "Electric and Hybrid Vehicles Design Fundamentals",CRC Press 2005.
2. Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, 2015.
3. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
4. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

e- Resources & other digital material

1. https://archive.nptel.ac.in/courses/108/106/108106182/
2. https://nptel.ac.in/courses/108106170
3. https://archive.nptel.ac.in/content/syllabus_pdf/108103009.pdf
4. https://en.wikipedia.org/wiki/Electric_vehicle
5. https://afdc.energy.gov/vehicles/electric.html

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IV Year II Semester

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Electric Power Quality

PRE-REQUISITES: 1. Power Electronics
2. FACTS Devices

Preamble: An Enlarged utilization of Power Electronics loads gives the awareness on the power quality. A reasonable understanding on the basics of various power quality problems and their solutions to applied electricity is therefore important for an electrical engineer. This course covers different power quality problems occurring in power system and provides brief idea about their solutions with comparative study.

Course objectives: The main objectives are

1. Different types of power quality phenomena and identify sources for voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.
2. Power quality terms and study power quality standards.
3. The principle of voltage regulation, power factor improvement methods and study the effect the harmonic distortion and its solutions.
4. The relationship between distributed generation and power quality.
5. The power quality monitoring concepts and the usage of measuring instruments

Unit-1 Introduction to Power Quality (12 Hrs)

Overview of power quality –Concern about the power quality –General classes of power quality and voltage quality problems –Transients –Long–duration voltage variations –Short–duration voltage variations –Voltage unbalance –Waveform distortion –Voltage fluctuation –Power frequency variations- Power quality terms –

Voltage sags, Voltage swells, and harmonics interruptions, voltage flicker and voltage spikes –Sources of voltage sag, swell and interruptions –Nonlinear loads. Source of transient over voltages –Principles of over voltage protection, Devices for over voltage protection –Utility capacitor switching transients.

Unit-2 Voltage Regulation and power factor improvement (12 Hrs)

Principles of regulating the voltage –Device for voltage regulation –Utility voltage regulator application –Capacitor for voltage regulation –Enduser capacitor application –Regulating utility voltage with distributed resources –Flicker –Power factor penalty –Static VAR compensations for power factor improvement.

Unit-3 Harmonic distortion and solutions (12 Hrs)

Voltage distortion vs. Current distortion –Harmonics vs. Transients –Harmonic indices –Sources of harmonics –Effect of harmonic distortion –Impact of capacitors, transformers, motors and meters –Point of common coupling –Passive and active filtering –Numerical problems.

Unit-4 Distributed Generation and Power Quality (12Hrs)

Resurgence of distributed generation –DG technologies –Interface to the utility system –Power quality issues and operating conflicts –DG on low voltage distribution networks.

Unit-5 Monitoring and Instrumentation (12 Hrs)

Power quality monitoring and considerations –Historical perspective of PQ measuring instruments –PQ measurement equipment –Assessment of PQ measuring data –Application of intelligent systems –PQ monitoring standards.

Content Beyond the syllabus:

Total Harmonic Distortion and Total Demand Distortion.

Course Outcomes

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

CO1 **Understand** the different types of power quality problems and analyze power quality terms and power quality standards. **{Apply level, KL2}**

CO2 **Explain** the principle of voltage regulation and power factor improvement methods. **{Evaluate level, KL3}**

CO3 **Analyze** the effect the harmonic distortion and its solutions. **{Analyze level, K34}**

CO4 **Demonstrate** the relationship between distributed generation and power quality**{Understand level, KL2}**

CO5 **Understand** the power quality monitoring concepts and the usage of measuring instruments. **{Explain level, KL2}**

Text books:

1. Electrical Power Systems Quality, Dugan R C, McGranaghan M F, Santoso S, and
2. Beaty H W, Second Edition, McGraw‐Hill, 2012, 3rd edition..
3. Electric power quality problems ‐M.H.J.Bollen IEEE series-Wiley India publications,2011.

Reference books:

1. Power Quality Primer, Kennedy B W, First Edition, McGraw‐Hill, 2000.
2. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M HJ, First Edition,IEEE Press; 2000.
3. Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley& Sons, 2003.
4. Electric Power Quality control Techniques, W. E. Kazibwe and M. H. Sendaula, VanNostradReinhold,New York.
5. Power Quality C.Shankaran, CRC Press, 2001
6. Harmonics and Power Systems ‐Franciso C.DE LA Rosa‐CRC Press (Taylor &Francis

e- Resources & other digital material

1. https://www.digimat.in/nptel/courses/video/108107157/L01.html
2. https://nptel.ac.in/courses/108106025
3. https://onlinecourses.nptel.ac.in/noc20_ee10/preview
4. https://onlinecourses.nptel.ac.in/noc20_ee10/preview

IV Year II Semester

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SCADA Systems and Applications

PRE-REQUISITES: 1) Power systems and Power Electronics

Course objectives: The student should be able to

1. understand about Supervisory Control and Data Acquisition System (SCADA)
2. Know the SCADA communication and its functions
3. Get an insight into its application

Unit -I Introduction to SCADA(10hrs)

Data acquisition systems, Evolution of SCADA, Communication technologies..**(04hrs)**

Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA. **(06hrs)**

Unit-II SCADA Components(11hrs)

Industries SCADA System Components, Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED). **(05hrs)**

Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems**(06hrs)**

Unit-III SCADA Architecture(10hrs)

Various SCADA architectures, advantages and disadvantages of each System**(5 hrs)**

single unified standard architecture -IEC 61850.**(5 hrs)**

Unit-IV SCADA Communication (12 hrs)

Various industrial communication technologies wired and wireless methods. **(06 hrs)**

Fiberoptics, Open standard communication protocols. **(06 hrs)**

Unit-V SCADA Applications: **(12 hrs)**

Utility applications, Transmission and Distribution sector operations, monitoring, analysis and improvement. **(06 hrs)**

Industries - oil, gas and water, Case studies, Implementation, Simulation Exercises. **(06 hrs)**

Course Outcomes

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

CO1	**Describe** the basic tasks of SCADA **{Describe level, KL2}**
CO2	Acquire **knowledge** about SCADA architecture, various advantages and disadvantages of each System {**knowledge level, KL1}**
CO3	**Understand** about single unified standard architecture IEC 61850**{understand level, KL2}**
CO4	**Understand** about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server. **{Understand level, KL2}**
CO5	**Apply** SCADA systems in transmission and distribution sectors **{Apply level, KL4}**

Textbooks:

1. Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, 2004
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and

Related Systems", Newnes Publications, Oxford, UK, 2004.

Reference books:

1. William T. Shaw, "Cybersecurity for SCADA systems", PennWell Books, 2006.
2. . David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 2003.
3. Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", PennWell 1999.

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