ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

ACADEMIC REGULATIONS (R20), COURSE STRUCTURE AND SYLLABI

For the students admitted to

B. Tech., Regular Four Year Electrical and Electronics Engineering Degree Programme from the Academic Year 2020-21, B.Tech Honors and Minors

and

B. Tech., Lateral Entry Scheme from the Academic Year 2021-22

VISION AND MISSION OF THE INSTITUTION

Vision

We impart futuristic technical education and instil high patterns of discipline through our dedicated staff who set global standards, making our students technologically superior and ethically strong, who in turn shall improve the quality of life of the human race.

Mission

Our mission is to educate students from the local and rural areas and from other states so that they become enlightened individuals, improving the living standards of their families, industry and society. We provide individual attention, world-class quality of Technical education and take care of character building.

ACADEMIC RULES AND REGULATIONS OF FOUR-YEAR B. TECH ELECTRICAL AND ELECTRONICS ENGINEERING REGULAR DEGREE PROGRAMME

APPLICABLE FOR THE STUDENT BATCHES ADMITTED FROM THE ACADEMIC YEAR 2020-21

APPLICABLE FOR THE STUDENTS (Lateral Entry) ADMITTED FROM THE ACADEMIC YEAR 2021-22

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1. PREAMBLE

Annamacharya Institute of Technology and Sciences (Autonomous), Rajampet, relentlessly aims to achieve academic excellence by implementing new initiatives in teaching-learning and evaluation processes. Based on the directions of the University Grants Commission (UGC), New Delhi, All India Council for Technical Education (AICTE), New Delhi and Jawaharlal Nehru Technological University Anantapur (JNTUA) Anantapuramu, the institute adopted AICTE and APSCHE model curriculum, with minor modifications to match the needs, expectations, and skillsets of students of the region, in both the under- graduate and post-graduate programmes offered from the academic year 2020-21.

2. APPLICATION AND COMMENCEMENT

- The regulations are quite comprehensive and include definitions of key terms, semester system, credit system, grading system and other relevant details.
- The regulations detailed herein shall apply to all the regular under-graduate programmes offered by the Institute.
- The regulations shall be applicable and come into force to the student batches admitted from the academic year 2020-21 and Lateral Entry students admitted from the academic year 2021-22
- The Institute may revise, amend or change the regulations, scheme of examinations and syllabi, from time to time, if found necessary and on approval by the Academic Council of the Institute, keeping the recommendations of the BoS in view.
- Any or all such amendments shall be effective from such date and to such batches of students including those already undergoing the programme, as may be approved through Academic Council of the Institute.
- These regulations shall be called R20 Regulations.

3. ELIGIBILITY FOR ADMISSION

3.1 ADMISSION INTO ENGINEERING UNDER GRADUATION PROGRAMMES (REGULAR)

The eligibility criteria for admission into engineering under graduate programmes offered at AITS shall be as prescribed by the Government of Andhra Pradesh. The criteria are given below:

- The candidate shall be an Indian National / NRI.
- The candidate should have completed 16 years of age as on 31st December of the academic year for which the admissions are being conducted.
- The candidate should have passed the qualifying examination (10+2) or equivalent as on the date of admission recognized by Board of Intermediate, Andhra Pradesh.
- Seats in each programme in the Institute are classified into two categories i.e., **Category – A** and **Category – B** as per the GOs of Andhra Pradesh.

Category – A Seats

These seats shall be filled through counselling as per the rank secured by a candidate in the Common Entrance Test (EAMCET) conducted by the Government of Andhra Pradesh and as per other admission criteria laid down in the GOs.

Category – B Seats

These seats shall be filled by the Institute as per the GOs issued by the Government of Andhra Pradesh from time to time

3.2 ADMISSION INTO SECOND YEAR (Lateral Entry Scheme)

A candidate shall be admitted into the third semester (II year I semester) based on the rank secured by the candidate in the Engineering Common Entrance Test (ECET) by the Government of Andhra Pradesh and as per other admission criteria laid down in the GOs.

4. Medium of Instruction

The medium of instruction shall be **English** for all the courses including their content delivery and examinations, seminars, presentations and project evaluation as prescribed in the programme curriculum.

5. B.TECH. PROGRAMME STRUCTURE

The structure of the B.Tech. Programmes on offer at AITS are based on the **Choice Based Credit System (CBCS)** as defined by the UGC and the curriculum / course structure as suggested by the AICTE and APSCHE in its Model Curriculum.

Semester Scheme

- The B. Tech Programmes offered at AITS follow **semester scheme** pattern.
- The duration of a B. Tech. Programme shall be of **4 academic** years for 4 year B. Tech programmes **and 3 academic years** for 3 year B. Tech programmes in lateral entry scheme**.**
- Each academic year shall have **2 semesters** i.e., odd and even semesters and shall be counted as first semester, second semester, and third semester and so on up to eighth semester.
- Each semester shall consist of **16 weeks** of academic work including internal examinations.
- Each semester is structured to provide credits totalling to **160 credits** for the entire B.Tech. Programme.
- Each semester shall have **Continuous Internal Evaluation (CIE)** and **Semester End Examination (SEE)** for both Theory and Lab courses.
- Each student is required to secure a total of **160 credits with a CGPA ≥ 5** for the completion of the UG programme and the award of the B.Tech. Degree.
- A student after securing admission into a 4 year B.Tech Programme at AITS shall pursue and acquire the B.Tech. degree in a **minimum period of four academic years i.e., 8 semesters** and a **maximum period of eight academic years i.e., 16 semesters** starting from the date of commencement of I year I

semester, failing which the student shall forfeit the seat in B.Tech. Programme.

- A student after securing admission into a 3 year B. Tech Programme (Lateral Entry) at AITS shall pursue and acquire the B.Tech. Degree in a **minimum period of three academic years i.e., 6 semesters** and a **maximum period of six academic years i.e., 12 semesters** starting from the date of commencement of II year I semester, failing which the student shall forfeit the seat in B.Tech. programme

6. PROGRAMMES OFFERED BY THE INSTITUTE

The following B. Tech. programmes are offered as specializations by the Institute from 2020-2021.

SNo	Name of the Program	Programme Code
1	Civil Engineering	01
2	Electrical and Electronics Engineering	02
3	Mechanical Engineering	03
4	Electronics and Communication Engineering	04
5	Computer Sciences and Engineering	05
6	Artificial Intelligence and Data Science	30
7	Computer Science and Engineering (Artificial Intelligence)	31
8	Computer Science and Engineering (Data Science)	32
7	Artificial Intelligence and Machine Learning	33

7. COURSES AND CREDIT STRUCTURE

Credit: A credit is a unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work/project per week.

Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

Choice Based Credit System (CBCS): CBCS provides choice for students to select from the prescribed courses.

Each course is assigned certain number of credits based on following criterion

Type of Class	Semester	
	Periods per Week	Credits
Theory (Lecture/Tutorial)	01	01
	02	02
	03	03
	04	04
Practical	02	01
	03	1.5
	04	02
Project Work / Internship	-	16.5

Every course of the B. Tech. programme shall be offered by a specific section / department. The unique codes of the section / department offering the courses are given in the Table.

Course offering Department	Code
Basic Science Courses	C
Humanities and Social Science Courses including Management Courses	
Civil Engineering	1
Electrical and Electronics Engineering	2
Mechanical Engineering	3
Electronics & Communication Engineering	4
Computer Science & Engineering	5
Artificial Intelligence and Data Science	30
Computer Science and Engineering (Artificial Intelligence)	31
Computer Science and Engineering (Data Science)	32
Artificial Intelligence and Machine Learning	33

Every B. Tech. Programme of study shall be designed to have theory and laboratory courses. In addition, a student shall carry out internship, project, socially relevant project, and other mandatory courses as prescribed in the curriculum of the Programmes.

7.1 Types of Courses:

TYPE OF COURSES	COURSE CATEGORY	CODE	DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
Foundation	Engineering Sciences	ESC	24
	Basic Sciences	BSC	21
	Humanities & Social Sciences and Management	HSMC	10.5
Core	Professional Core	PCC	51
Project	Project (12)	PROJ	16.5
	Internship (4.5)		
Elective courses	Professional Elective	PEC	15
	Open Elective (including two MOOCs)	OEC	12
Mandatory Courses	Mandatory	MC	-
Skill Oriented Courses		SC	10
Total Credits			160

7.1.1 Foundation Courses

Engineering Science courses, Basic Science Courses and Humanities courses are termed as Foundation Courses and are mostly offered at I and II Year.

7.1.2 Professional Core Courses

Professional Core Course is to be completed by all students of respective programme before they can move on to the next semester.

7.1.3 Professional Core Electives

University Grants Commission has come up with the Choice Based Credit System (CBCS) in which the students have a choice to choose from the prescribed courses, which are referred as Professional elective and Open Elective courses. All the Professional and Open elective courses shall be offered for 3 credits.

Students have to register for a total of 5 professional core electives courses (PEC-1 to PEC-5) from the list of track-wise professional elective course as prescribed in the course structure of the programme. The following points are considered for a Professional Elective Course.

- Maximum strength of a class /section for each semester shall be 72.
- A course may be offered to the students, only if a minimum of 24 students (1/3 of the section strength) opt for it.
- The selection of course based on the choice for students shall be on 'first come first serve' through on line and off line registration.
- The Head of the department or concerned shall decide, whether or not to offer such course keeping in view the resources available in the department offering the course.

7.1.4 Open Electives

Choice Based Credit System (CBCS) is promoted in such a way that different open elective courses should be offered by every department in engineering to other departments. This interdisciplinary of learning open elective courses by other department students will have learning awareness and job-oriented benefits. Students require the opportunity to choose any open elective course from different departments and apply their knowledge to acquire jobs in that field of course. Learning and employment benefits are not only through their own course subjects but also through open elective courses.

Every student shall earn prescribed credits by choosing one of the open elective courses from the list of Open Electives given in the Curriculum. Further students from a particular program/branch can opt for one Open Elective (OEC1) offered by their concerned department. However, one Open Electives (OEC2) is inter-disciplinary and shall be offered by other branches.

Two Open electives (OEC3 & OEC4) are to be chosen from the repository of **inter-disciplinary MOOCs** courses offered by NPTEL or any other recognized Institutions/Organization. Students shall consult their

class mentors before opting for an open elective course (MOOCs)

The following guidelines are pertaining to Open Elective Courses.

- Maximum strength of a class /section for each semester shall be 72.
- A course may be offered to the students, only if a minimum of 24 students (1/3 of the section strength) opt for it. The minimum number of students is required to register the course to offer opted course in the department.
- The selection of course based on the choice for students shall be on 'first come first serve' through on line and off line registration.
- The Head of the department or concerned shall decide, whether or not to offer such course keeping in view the resources available in the department offering the course.

7.1.5 Massive Open Online Courses as Open Elective

- MOOCs (Massive Open Online Courses) are introduced to meet with the global requirements and to inculcate the habit of self-learning and in compliance with the UGC guidelines
- A student shall be permitted to pursue up to a maximum of two electives courses under MOOCs during programme. Each of courses must be of minimum 12 weeks in duration.
- Concerned departments **shall declare the list of inter-disciplinary** courses that a student can pursue through MOOCs at the beginning of the corresponding semester.
- Students interested in pursuing MOOCs shall register for the course and submit this information at their department office at the start of the corresponding semester.
- Course content for the selected MOOCs shall be drawn from the respective MOOCs offering Portal.
- Course progress shall be monitored by the Mentors designated by the HoD.
- Grade obtained through the evaluation of the MOOC shall be considered for the CGPA calculation.
- Three credits shall be awarded to the student upon successful completion of MOOC.
- In case a student fails to complete the MOOCs he/she shall re-register for the same with the same provider, already offered that course. In case that provider discontinues to offer the course, Institution shall conduct an offline examination in the same format, which student already appeared in online examination, as per the MOOC syllabus.

7.1.6 Skill Oriented Courses

- There shall be 5 skill oriented course offered during 3rd to 7th semester. Among the 5 skill oriented courses, 4 courses shall focus on the basic advanced skills related to the domain courses and remaining 1 shall be a soft skills course.
- Skill oriented / skill advanced courses carry 2 credits
- For skill oriented/skill advanced course, 1 theory and 2 practical hours may be allotted as per the

decision of concerned BOS.

- Out of the 5 skill courses 2 shall be skill-oriented courses from the same domain and shall be completed in 2nd year. Of the remaining 3 skills course, 1 shall be necessarily be a soft skill course and the remaining 2 shall be skill advanced courses either from the same domain or job oriented skill course, which can be of inter-disciplinary nature.
- A pool of interdisciplinary job-oriented skill course shall be designed by a common Board of studies by the participating departments and the syllabus along with the pre-requisites shall be prepared for each of the laboratory infrastructure requirements,
- The student shall be given an option to choose either the skill courses being offered by the institute or to choose a certificate course being offered by Industries/Professional Bodies/ APSSDC or any other accredited bodies as approved by the concerned BOS.
- If a student chooses to take a certificate course offered by Industries/Professional Bodies/ APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the department, the credits shall be awarded to the student upon producing the course completion certificate from Industries/Professional Bodies/ APSSDC as approved by the concerned BOS.
- If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill oriented course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the concerned BOS, the student is deemed to have fulfilled the attendance requirements of the course and acquire the credits assigned to the course.
- A committee shall be formed at the level of the institute to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks are to be approved by the Academic Council

7.1.7 Mandatory Courses

- A student shall pursue mandatory courses as specified in the course structure of the B.Tech. Programme.
- These courses are among the compulsory courses and do not carry any credits.
- A student has to secure 40 marks out of 100 in the Internal Examination, shall be necessary requirement for the student to qualify for the **award of Degree**.
- Result of mandatory courses shall be declared with **"Pass"** or **"Fail"** performance in the Comprehensive Marks Memo.
- No marks or letter grade shall be allotted.
- Attendance in the mandatory course shall be considered while calculating aggregate attendance.

7.1.8 Universal Human Values (UHV) Courses

- Universal Human Values-I shall be offered during the Student Induction Programme with no credits.
- Universal Human Values-II course carries 3 credits. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.
- A student has to secure 40% marks out of 100 in the CIE and SEE together to qualify for the award of the degree. The distribution shall be 50 marks for continuous internal assessment and 50 marks for semester end examination.
- Internal evaluation shall be conducted for the course during semester and shall be evaluated for 50 marks and distributions of marks as follows:
    - Assessment by faculty mentor: 10 marks
    - Self-assessment: 10 marks
    - Assessment by peers: 10 marks
    - Socially relevant project/Group Activities/Assignments: 20 marks

8. Evaluation Process

The performance of a student in each semester shall be evaluated course-wise with a maximum of 100 marks for both Theory and Lab Course.

- For a Theory course, the distribution shall be 30 marks for Internal Evaluation and 70 marks for End-Examinations. The distribution is detailed in 8.1.1.
- For a Lab course, the distribution shall be 30 marks for Internal Evaluation and 70 marks End-Examinations. The distribution is detailed in 8.1.3
- Project Work shall be evaluated for 200 marks. Mandatory courses with no credits shall be evaluated for 100 marks.

8.1 Internal Evaluation

For a Theory Course, 30 marks are allotted for Internal Evaluation. Two Internal examinations (Theory Internal Examinations) shall be conducted for a Theory Course during a semester and they shall be evaluated for 30 marks of which 25 marks are given for Internal Examination and 5 marks for assignment. For Lab Course, there shall be a continuous internal evaluation during the semester for 30 marks.

8.1.1 Theory Internal Examinations

Theory internal examination shall have Part A & Part B. In Part A, which is compulsory, five short answer questions each of which carries one mark. There shall be no sub-questions or bits or fill-up the blanks. The examination shall be conducted for 2 hours.

Part B shall contain three either type questions (Total six questions from 1 to 6). Each question shall carry 10 marks. 30 marks allotted for Part B shall finally be scaled down to 20 marks. The questions shall be set/ moderated such that the student can comfortably answer each question within the stipulated time.

Question paper pattern for Internal Examination (25 Marks) shall be as follows:

PART A: Five short answer questions - 5 x 1 = 5 Marks

PART B: 30 Marks (will be scaled to 20 marks)

(i) There shall be three questions with internal Choice i.e., 'either' or 'choice'

(ii) The student shall answer three questions

First Theory Internal examination shall be conducted as per the syllabus of I & II units. The second internal examination shall be conducted as per the syllabus of III, IV and V units. 80 % weightage for the best performance and 20 % the other shall be considered.

For Example:

Marks obtained in I Internal examination: 19

Marks obtained in II Internal examination: 10

Final Internal Marks: (19x0.8) + (10x0.2) = 17.2

If the student is absent for any one Internal examination, the final internal marks shall be arrived at by considering 80% weight age to the marks secured by the student in the appeared examination and zero to the other.

For Example:

Marks obtained in first Internal: 0 (Absent); Marks obtained in second Internal: 18

Final Internal Marks: (18x0.8) + (0x0.2) = 14.4

Note: For some courses namely, Engineering Graphics and Engineering Graphics & Design, the distribution of internal evaluation and external evaluation marks shall be 30 and 70 respectively.

Of the 30 internal evaluation marks, day-to-day performance of the student shall be evaluated for 20 marks and internal examination carries 10 marks. Day-to-day work shall be evaluated by the teacher concerned based on the exercises/submissions/assignments prepared in the class. Two internal examinations shall be conducted in a semester for duration of 2 hours each for 10 marks with a weightage of 80% for better of the two and 20% for the other. The sum of day-to-day work and the internal examination marks will be the final internal evaluation for 30 marks for the subject. End examination shall be for 70 marks and is of 3 hours

duration. The question paper shall be with 5 questions, one question from each unit with internal choice. All questions carry 14 marks each.

8.1.2 Assignment (Theory)

The assignment shall contain essay type questions/numerical problems etc.., the assignments is given by the concerned class teacher for five marks from first two units. The second assignments shall give from rest of the syllabus. The first assignment should be submitted before the conduct of the first internal examination, and the second assignment should be submitted before the conduct of the second internal examination. There shall be at least two assignments in a semester and performance of one best out of two assignments to be considered.

8.1.3 Lab Internal Evaluation

Out of the 30 marks allotted for Lab Internal Evaluation, day-to-day performance of the student in the laboratory shall be evaluated for 20 marks by the concerned laboratory teacher based on experimental evaluation/record/viva. Two Lab Internal examinations shall be conducted for 10 marks by the concerned teacher. Performance of one best out of two tests to be considered.

8.1.4 Internal Evaluation of Mandatory Courses

Mandatory courses are offered with no credits. However, a student has to complete Mandatory Courses in order to be eligible for the award of the Degree. There shall be an Internal Examination for 100 marks. A student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examination. In case, the student fails, a supplementary examination shall be conducted.

8.1.5 Make-up Internal Evaluation

The student who has missed both the Theory Internal examinations will be permitted to appear for a Make-up Internal examination in the event of his/her producing satisfactory evidences of medical ailment. One Make-up internal test shall be conducted immediately after the II Internal examination in the same semester, covering the total syllabus of FIVE Units in the respective course.

This Make-up examination will be given a weightage of 80%. Make-up tests shall be conducted outside the working hours and there can be even two such examinations on a day.

Student absent for I Internal examinations with valid reasons he/ she should produce a supporting document to the department within a week after completion of last internal examination. And the same student absent for same subject in II Internal examination, he/ she should produce a supporting document to the department immediately in order to giving the provision for makeup examination.

Make-up internal examinations are not for improvement of marks in Theory Internal examinations. There shall be no make-up internal examinations for a Lab course.

8.1.6 Evaluation of Skill oriented / Skill advanced / Soft Skills course

Course type: Laboratory

Distribution of marks: 30:70

Evaluation Type: Internal Evaluation

A student is evaluated for a maximum of 100 marks with respect to skill oriented course / Skill advanced courses / Soft skill course. The distribution of marks shall be 30 for internal evaluation and 70 for external evaluation. For Internal Evaluation, day-to-day performance of the student in the laboratory shall be evaluated for 30 marks by the concerned skill oriented course / Skill advanced courses / Soft skill course class teacher based on experimental evaluation / discussions / results / reports. External evaluation is done for 70 marks in a laboratory end semester examination conducted for 3 hours.

Note: Each skill oriented course / Skill advanced courses / Soft skill course will have its own evaluation procedure and weightage.

8.2 End Evaluation

8.2.1 Theory End Evaluation

As specified in 8.0, Theory End Evaluation is done for 70 marks. End examination of theory subjects shall be conducted at the end of semester. There shall be Regular and Supplementary End Examinations. Theory End Examination shall be conducted for 70 marks and is of 3 hours duration.

Theory end examination shall have Part A & Part B. In Part A, which is compulsory, five short answer questions each unit of which carries two marks shall be given. There shall be no sub-questions or bits or fill-up the blanks.

Part B shall contain five either type questions (Total 10 questions with internal choice). 60 marks allotted for Part B and each question shall carry 12 marks. There will be one question from each unit. The examination shall be conducted for 3 hours.

Question paper pattern for Semester End Examination (70 Marks) shall be as follows:

PART A: 5 x 2 = 10 Marks

(i) There shall be one question from each unit

(ii) Part A is compulsory.

PART B: 5 x 12 = 60 Marks

(i) Five questions with internal choice will be given

(ii) There shall be one question from each unit with Internal Choice i.e., ‘either’ or ‘choice’

(iii) Sub questions may also be given.

8.2.2 Lab End Examination

As specified in 8.0, Lab End Evaluation is done for 70 marks, in the form a Lab End Examination that shall be conducted for 3 hours in respective Laboratory. Each lab course will have its own evaluation procedure and weightage.

8.2.3 Supplementary Theory/Lab End Examinations

- Supplementary examination shall be conducted along with regular semester end examinations.
- During Semester End Examinations of even semester, supplementary examinations of odd semester shall be conducted and during semester end examinations of odd semester, supplementary examinations of even semester shall be conducted.
- The same schedule is applicable to Supplementary Lab End Examinations. Supplementary examination shall be conducted along with the next batch of students or separately.
- Advanced supplementary shall be conducted only for Final Year II semester Students in view of their higher education pursuits and placement opportunities.
- In case of seminars and comprehensive viva-voce examinations, supplementary seminar / comprehensive viva-voce will be conducted along with the next batch of students. If the next batch of students is not available, a separate supplementary examination will be conducted.

8.2.4 Challenge Evaluation, Revaluation and Recounting

Students may visit Examination Section Webpage for Norms and Procedures for Challenge Evaluation, Revaluation and Recounting of Answer Scripts. (Refer to Appendix II).

9.0 Internship and Project Evaluation

9.1 Summer Internship / Research Internship (Industry / Govt. / NGO / MSME / Online)

- A student shall carry a mandatory Internship for 2 months for 1.5 credits in 2nd year 2nd semester during summer vacation and it is evaluated during 3rd year 1st semester. A student shall carry a mandatory Industrial / Research Internship for 2 months for 3 credits in 3rd year 2nd semester during summer vacation and it is evaluated during 4th year 1st semester.
- Two summer internships each with a minimum of 6 weeks duration. Done at the end of 2nd and 3rd year, respectively are mandatory. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs
- Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned departments and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightages respectively.

- In the final semester, the student should mandatorily undergo internships and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidates shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.
- The institute shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.
- There shall also be mandatory full internship in the final semester of the programme along with the project work.
- For other details, please refer to Appendix I.

9.2 Project Work

Project work consists of a presentation of **Abstract of the main project** in the beginning of 8th Semester. After selecting specific topic, the student shall collect the information and prepare a report, showing his/her understanding of the topic and submit the same to the department before presentation. Project shall be evaluated for a total of 200 marks. The technical presentation/report shall be evaluated by a committee consisting of Head of the Department along with two senior faculty members of the Department. A student shall acquire 12 credits assigned, if her/his report is declared Satisfactory by the committee based on Rubrics set by the Department for evaluation.

Out of a total of 200 marks for the **Project work,** The internal evaluation shall be carried for 50 marks done by a committee consisting of HOD, Project Supervisor and senior faculty member of the department and the remaining 150 marks shall be awarded by a committee consisting of HOD, project Supervisor and an External Examiner nominated by the Principal or Dean Academics. The internal evaluation shall be done on the basis of two seminars conducted in a semester as per the academic calendar and stipulated rubrics. In case, if a student fails in Project work, a re-examination shall be conducted within a month. In case he/she fails in the re-examination also, he/she shall not be permitted register for viva voce examination. Further such students shall re-appear as and when next year 8th semester supplementary examinations are conducted.

10. Curricular Framework for Honors Programme

- Students of a Department/ Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline
- A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 SGPA up to the end of 2nd

semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

- Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/ she will be awarded B.Tech (honors) in Mechanical Engineering.
- In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B.Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
- Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.
- It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.
- The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
- Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component. (Model pool list is enclosed in the end of the syllabus)
- MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC Courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the Academies Council.

- The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech Programmes for the requirement of B.Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.
- If a student drops or is terminated from the Honors programme, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
- In case student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with honors and they will receive regular B.Tech degree only, however, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- Honors must be completed simultaneously with a major degree Programme. A student cannot earn Honors after he/she has already earned bachelor's degree.

11. Curricular Framework for Minor Programme

- a) Students who are desirous of pursuing their special interest areas other than the choses discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, if Mechanical Engineering student select subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering.

  b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine Learning track etc.
- The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance/demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc., or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric Vehicles, and VLSI etc.,
- The list of disciplines / branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

- There shall be no limit on the number of programs offered under Minor. The Institute can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the Programme.
- The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
- A student shall be permitted to register for Minors Programme at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA up to the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA up to 3rd semester or failed in any of the courses, his/her registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.
- A student shall earn additional 20 credits in the specified area to be eligible for the award of B.Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
- Out of the 20 credits, 16 credits shall be earned by undergoing specified course listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.
- In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is pass/fail course without any grades, the grade to be assigned as decided by the Academic Council.
- Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

- A committee should be formed at the level of Institute / Department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committees should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.
- If a student drops (or terminated) from the Minor Programme, they cannot convert the earned credits into free or core electives, they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following:
    - All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Miner will be shown in the transcript.
- In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/ she will be dropped from the list of students eligible for degree with Minors and they will receive B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- Minor must be completed simultaneously with a major degree Programme. A student cannot earn the Minor after he/she has already earned bachelor's degree.

12. Attendance Requirements and Detention Policy

- A student shall maintain a minimum required attendance of 40 % in each subject and 75 % in AGGREGATE of all the subjects in a semester.
- Shortage of attendance up to 10 % i.e., attendance between 65 % to 75 % in aggregate, may be condoned by the Institute Academic Committee based on the rules prescribed by the Academic Council of the Institute from time to time.
- A stipulated fee shall be payable towards condonation of shortage of attendance.
- Shortage of attendance below 65 % shall in no case be condoned. A stipulated fee shall be payable towards condonation of shortage of attendance to the Institute as per following slab system

  1stSlab: Less than 75 % attendance but equal to or greater than 70 % a normal condonation fee can be collected from the student.

  2ndSlab: Less than 70 % but equal to or greater than 65 %, double the condonation fee can be collected from the student.
- Students whose shortage of attendance is not condoned OR who have not paid the stipulated fee OR who have not cleared any other due to the Institute in any semester are not eligible to write the Semester End Examination (SEE).

- Students, who do not meet the minimum required attendance of 65% in a semester, shall be detained in that semester and their registration for that semester shall stand cancelled. They shall not be promoted to the next semester.
- Students detained in a semester shall seek re-admission into that semester as and when offered.
- Academic regulations applicable to the semester in which re-admission is sought shall be applicable to the re-admitted student.
- In case, there are any professional electives and /or open electives, the same may also be re-registered, if offered. However, if those electives are not offered in the later semesters, then alternate electives may be chosen from the same set of elective courses offered under that category.

  Any student against whom any disciplinary action is pending shall not be permitted to attend semester end examination (SEE) in that semester.

13. Minimum Academic Requirements and Award of the Degree

The following Academic Requirements have to be satisfied in addition to the attendance requirements mentioned in section 10.

13.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory and lab courses, and project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the total of the internal and end examination marks taken together. In case of mandatory courses, he/she shall secure 40% of the total marks.

13.2 A student admitted in 4 year B. Tech programme, shall be promoted from 4th to 5th Semester only if he/she fulfills the academic requirements of securing a minimum of 50% credits from I year I and II-Semesters, II year I and II-Semesters examinations conducted till that time. A student admitted in 3 year B. Tech programme, shall be promoted from 4th to 5th Semester only if he/she fulfills the academic requirements of securing a minimum of 50% credits from II year I and II-Semesters examinations conducted till that time.

13.3. A student admitted in 4 year B. Tech programme, shall be promoted from 6th to 7th Semester only if he/she fulfills the academic requirements of securing a minimum of 50% credits from I year I & II-Semesters, II year I & II-Semesters and III year I & II-Semesters examinations conducted till that time.

A student admitted in 3 year B. Tech programme, shall be promoted from 6th to 7th Semester only if he/she fulfills the academic requirements of securing a minimum of 50% credits from II year I & II-Semesters and III year I & II-Semesters examinations conducted till that time. And in case a student is detained for want of credits for particular academic year by sections 11.2 and 11.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the 5th semester or 7th semester as the case may be.

13.4 A student shall register and put up minimum academic requirement of all 160 credits and earn all 160 credits for the award of B. Tech degree

13.5 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

14. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The performances of students in each of the courses in the Programme are expressed in terms of letter grades based on an absolute grading system. We use 10-point grading system with letter grades. They are given in the following table.

Marks Obtained	Letter Grade	Description	Grade Points (GP)
≥90	A+	Outstanding	10
≥80 and ≤89.99	A	Excellent	9
≥70 and ≤79.99	B	Very Good	8
≥60 and ≤69.99	C	Good	7
≥50 and ≤59.99	D	Average	6
≥40 and ≤49.99	E	Pass	5
<40	F	Fail	--
Absent in the exam(s)	Ab	Absent	--

A student is eligible for the award of the B.Tech. Degree with the class as mentioned in the following table

CGPA	Class
≥7.5	First class with Distinction
≥6.5 and <7.5	First Class
≥5.5 and <6.5	Second Class
≥5.0 and <5.5	Pass

For mandatory courses, student shall be awarded “pass” or “fail “without any credit. This shall not be counted for the computation of SGPA/CGPA

14.1 Computation of SGPA

The performance of each student at the end of each semester shall be indicated in terms of SGPA. The SGPA shall be calculated as follows:

$$SGPA = \frac{Total\ earned\ weighted\ grade\ points\ in\ a\ semester}{Total\ credits\ in\ a\ semester}$$

$$SGPA = \frac{\sum_{i=1}^{p} C_{i.}.G_i}{\sum_{i=1}^{p} C_i}$$

Where

$C_{i.}$ = Number of credits allotted to a particular curse 'i'

G_i= Grade point corresponding to the letter grade awarded to the course i

$i = 1,2,\ldots$.p represent the number of courses in a particular semester.

Note: SGPA is calculated and awarded to those students who pass all the courses in a semester.

14.2 Computation of CGPA

The performance of a student shall be obtained by calculating Cumulative Grade Point Average (CGPA), which is weighted average of the grade points obtained on all courses during the course of study

$$CGPA = \frac{Total\ earned\ weighted\ grade\ points\ for\ the\ entire\ programme}{Total\ credits\ for\ the\ entire\ program}$$

$$CGPA = \frac{\sum_{j=1}^{m} C_{j.}.G_j}{\sum_{j=1}^{m} C_j}$$

Where

$C_{j.}$ = Number of credits allotted to a particular semester 'j'

G_j = Grade point corresponding to the letter grade awarded to the semester j

$j = 1,2,\ldots$.m represent the number of semester of the entire programme.

14.3 Grade Card

The grade card issued shall contain the following

- The credits for each course offered in that semester
- The letter grade and grade point awarded in each course
- The SGPA and CGPA
- Total number of credits earned by the student up to the end of that semester

Example: - Computation /calculation of SGPA

Course name	Credits (C)	Letter grade	Grade point (GP)	Credit point (CP=C*GP)
Course 1	4	A	9	4x9=36
Course 2	3	A+	10	3*10=30
Course 3	2.5	A+	10	2.5*10=25
Course 4	1.5	C	6	1.5*6=9
Course 5	1	D	5	1*5=5
Total	12			105

Therefore, SGPA= $\frac{105}{12}$ 8.75

Example Illustration of CGPA

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5
Credit: 20 SGPA : 8.75	Credit : 20 SGPA : 8.25	Credit : 22 SGPA : 7.89	Credit: 23 SGPA : 8.21	Credit : 22 SGPA : 7.86

Thus, CGPA = $\frac{20*8.75+20*8.75+22*7.89+23*8.21+22*7.86}{107} = 8.34$

Similarly, compute CGPA obtained at the end of 8th semester shall be the final CGPA secured by the student for the entire programme.

14.4 Conversion of SGPA into percentage

In case of a specific query by students/employers regarding Semester Grade Point Average (SGPA)/ Cumulative Grade Point Average (CGPA) into percentage, the following formulae will be adopted for notional conversion of CGPA into percentage.

Percentage = (CGPA - 0.50) * 10

14. Transcripts

After successful completion of the entire programme of study, a transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued, if required, after payment of requisite fee. Partial transcript will also be issued up to any point of study to a student on request.

16. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted. Candidates who are permitted to avail gap year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

17. Readmission of Students

A student who has satisfied the minimum attendance requirement in any semester may repeat that semester, after obtaining written permission from the Principal and cancelling the previous record of attendance and academic performance (viz; internal evaluation and external evaluation marks) of the semester or year. This facility may be availed by any student at the maximum twice for a 4 year B. Tech, and only once by Lateral Entry student & PG student during the entire course of study.

18. Minimum Instruction Days for a Semester

The minimum instruction days including exams for each semester shall be 16 weeks.

19. Student transfers

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the affiliating University from time to time.

20. Announcement of results

- Results review committee comprising of University nominee, Principal, Dean Academics, Chairmen of various boards of studies, Controller of Examinations and Deputy Controller of Examinations will monitor the results and gives the permission for announcement of results.
- After review meeting results are loaded in to Institution website from which students can access their results by entering Hall Ticket number. And also results in form of hard copy are available with respective Heads of the departments.

21. General Instructions:

- The academic regulations should be read as a whole for purpose of any interpretation.
- Malpractices rules-nature and punishments are appended.
- Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
- In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal/ Governing body is final.
- Any legal issues are to be resolved in Rajampet Jurisdiction.
- The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Institute.

Appendix-I: Internship Guidelines

The Head of the Department will arrange internship for students in industries/organization after fifth semester or as per AICTE/ affiliating University guidelines. Institutions may also device online system for arranging &managing internships. The general procedure for arranging internship is given below:

Step 1: Request Letter/ Email from the office of HOD of the department should go to industry to allot various slots of 4-6 weeks during summer vacation as internship periods for the students. Students request letter/profile/ interest areas may be submitted to industries for their willingness for providing the training.

Step 2: Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email. In case the students arrange the training themselves the confirmation letter will be submitted by the students in the office of Training & Placement through concerned department. Based on the number of slots agreed to by the Industry.

Step 3: Students on joining Training at the concerned Industry / Organization, submit the Joining Report/ Letters / Email.

Step 4: Students undergo industrial training at the concerned Industry / Organization. In-between Faculty Member(s) evaluate(s) the performance of students once/twice by visiting the Industry/Organization and Evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers.

Step 5: Students will submit training report after completion of internship.

Step 6: Training Certificate to be obtained from industry.

Step 7: List of students who have completed their internship successfully will be issued by concerned Department.

For more details refer:

https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

Appendix II: Norms and Procedures for Challenge Evaluation/Revaluation/Recounting

Revaluation / Recounting:

- The students who wishes to apply for Revaluation/Recounting of his/her answer-books(s) must submit his/her application on the prescribed from together with the requisite fee to the Controller of Examinations before expiry of 15 days excluding the date of the declaration of his/her examination result. Application not received in the prescribed form or by the due date or without the requisite fee shall be rejected.
- After Recounting / Revaluation, records are updated with changes if any and the student will be issued a revised memorandum of marks. If there are no changes, the student shall be intimated the same through a notice.
- No Revaluation / Recounting for Laboratory Examination.
- The students are informed to be more careful in furnishing the information while applying for Recounting / Revaluation. The applications with insufficient information will be summarily rejected and the student has to forfeit the amount paid in this connection.

Challenge valuation:

- Applications are invited from the students, who wish to apply for Challenge Valuation in the subjects of the B.Tech Regular and Supplementary examinations
- The student will apply for Challenge valuation in a specified application and should be routed through the HOD concerned.
- The students who have applied for the revaluation for a paper(s) of an examination are only eligible for the Challenge Valuation of that paper(s) of that examination.
- A Fee of Rs. 10000/- (Ten Thousand Rupees Only) for each paper is to be paid within the last date for challenge valuation.
- A Xerox copy of the answer script will be provided to the student on receipt of the payment of fee and date and time of the valuation will be informed to the student, so that valuation will be done in the presence of the teacher attended in support of the student nominated by the HOD concerned.
- The HOD concerned will nominate a teacher of the concerned subject to observe the valuation in support of the student. This will be done on the request of the student.
- If the marks obtained in the challenge valuation are more than or equal to 15% of the maximum marks with respect to the original marks obtained in the first valuation, then the marks obtained in the Challenge valuation will be awarded to the student and the institute will pay back Rs 9,000 (Nine thousands rupees only) to the student. If the student status changes from fail to pass, an amount of Rs. 5000 will be refunded to the student. Otherwise there will not be any change in the result of the student and original marks will be retained and the student will forfeit the fee paid.
- No Challenge valuation for Laboratory Examination

APPENDIX III: Rules for Disciplinary Action for Malpractices / Improper Conduct in Examinations

Malpractices identified by squad or special invigilators or invigilators

Punishments shall be given to the students as per the above guidelines. The case is to be referred to the malpractice committee.

Malpractice committee

1. The Principal, Chairman
2. Dean, Academics, Member
3. Invigilator, Member
4. Subject expert, Member
5. Concerned Head of the Department, Member
6. Controller of Examinations, Member Secretary

Note:

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fill all the norms required for the award of Degree.

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
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 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.
7.	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 for four 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. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's 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 four consecutive semesters from class work and

		all University examinations, if his involvement is established. Otherwise, the candidate is 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 only.
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 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.	In case of student 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. If the candidate physically assaults the invigilator/officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
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.
10.	Possess any lethal weapon or firearm in the	Expulsion from the examination hall and cancellation of the

	examination hall.	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 students of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in nay malpractice or improper conduct mentioned in class 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 does not belong to the College will be handed over to police and, a police case will be registered against them.
11.	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.
12.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee.
13.	If any malpractice is detected which is not covered in the above clauses 1 to 12 shall be reported to the University for further action to award suitable punishment.	

Activities (Non-Credit) as per AICTE Guidelines
List of Activities

1. Physical and Health

1.1 Physical Activities: (a) Games and Sports, (b) Gardening (c) Tree Plantation (d) Yoga:
1.2 NCC/NSS: Standard procedure

2. Culture

2.1 Learning an art form: music, dance, theatre, painting, and other art forms
2.2 Heritage: Visit to museum, archaeology sites, cultural walks, tours, local traditions
2.3 Intangible Cultural Heritage: Festivals, Food ways, Local Games

3. Literature & Media

3.1 Literature, Cinema and Media: workshop, reading multiple news sources, analyse ads
3.2 Group reading: Group sits and each person reads aloud (if possible, with proper modulation) taking turns. This if done properly for an hour one may complete 30-40 pages in an hour

4. Social Service

4.1 Social Awareness: Artisans-relates to engg., visit to hospitals, orphanages, police station, courts, trauma centres, consumer forums
4.2 Social Service: teach in neighbourhood, adopt an underprivileged school, village stay / visit (NSS), cleanliness drive, and skill transfer

5. Self-Development

5.1 Spiritual, Mindfulness & Meditation
5.2 Religion and Inter-faith: Reading of books on religious texts of different faiths by famous authors, organizing lecture on interfaith issues covering philosophies and chronology and contemporary situations world over at a given time
5.3 Human Values
5.4 Behavioural and Interpersonal skills: Motivational lectures, Group Discussions/activities, Case Study, Games/Stimulation Exercises, Role-Playing, Mindfulness training.
5.5 Lectures: Areas could be from science, engineering, social sciences, arts or even politics.

6. Nature

6.1 Nature Club: bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity
6.2 Environment Protection (non-credit course)

7. Innovation

7.1 Project based – Sc. Tech., Social, Design & Innovation: (a) Exposure to social problems (which are amenable to technological solutions) (b) Design & Innovation (to address above problems)

First 3-weeks – Induction Program will have Physical activities (*), Learning an art form (*), Literature & Cinema, Social Awareness (*) Lectures, Visits to local areas, Universal Human Values (*)

(*) It is the core part of Induction Program (Besides Familiarization to the College, Department and Branch career opportunities)

After first 3 weeks (1st semester)

Based on student interest – the above may be continued

Universal Human Values Groups – Meet once a week with 1st year students with the same faculty mentor & senior student guide.

Semester 2 to 4

Every student should register for some activity mentioned above in every semester. Spend 3-5 hours per week on the activity.

1. Environment Science (mandatory non-credit course prescribed at 1/2 semester)
2. Life Sciences for Engineers (mandatory non-credit course prescribed at 3/4 semester)
3. Constitution of India (mandatory non-credit course prescribed at 5/6 semester)
4. Essence of Indian Traditional Knowledge (mandatory non-credit course prescribed at 5/6 semester)

For mandatory non-credit courses, these will be graded as Pass or Fail (P/F). Thus, the grades obtained will not affect the grade point average. However, they will appear on the grade sheet.

Semester 5 to 8

Every student should register for some activity mentioned above in every semester. Spend 3-5 hours per week on the activity. For activities, suitable registration system in case of the semesters will be developed.

STUDENT INDUCTION PROGRAMME (Zero Semester)

Induction programme for newly admitted students is conducted in line with AICTE/UGC Induction programme policy, every year before the commencement of the first semester classes. The objective of the Induction programme is to demystify what is expected of students in Intermediate level and to provide adequate foundation in the core applied science subjects and English limited to moderate level so that students do not face any difficulty when the classes commence.

The syllabus for the course is framed in such a way that equal importance is given to both Engineering discipline and personality development which includes soft skills, sports and cultural Activities. The duration of the induction programme is **THREE** weeks. The students are trained in Foundation courses, basics of programming and English apart from other co-curricular and extra-curricular activities.

The objective of the Induction Programme is to work closely with the newly joined students in order to facilitate the following:

- Make the students feel comfortable in the new environment
- Allow them to explore their academic interests and activities
- Reduce competition and make them work for excellence
- Promote bonding within them
- Build relations between teachers and students
- Give a broader view of life
- Build character

Phase	Course Code	Name of the course	Lecture	Practical
Regular Phase	20A501	Proficiency classes: Familiarity with a computer	2	2
Regular Phase	20AC01	Proficiency classes: English Communication Skills	2	2
Regular Phase	20A502	Basics of Programming and Lab	3	2
Regular Phase	20AC02	Foundation classes in Mathematics	3	0
Regular Phase	20AC03	Foundation classes in Physics	3	2
Regular Phase	20AC04	Foundation classes in Chemistry	3	2
Regular Phase	20AC05	Universal Human Values I	2	0
Regular Phase	20A301	Fundamentals of Engineering Drawing	1	0
Regular Phase	-	Physical education activities – Sports and Games	0	1
Non daily	-	Creative Arts		
Non daily	-	Lectures by eminent personalities		
Non daily	-	Visits to local area		
Non daily	-	Extra-curricular activities		

BASIC STRUCTURE FOR ELECTRICAL & ELECTRONICS ENGINEERING

(R20 regulations)

Semester I (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	20AC11T	Algebra and Calculus	3	0	0	3
2	BSC	20AC12T	Applied Physics	3	0	0	3
3	ESC	20A511T	Problem Solving through C Programming	3	0	0	3
4	ESC	20A312T	Engineering Drawing	1	0	4	3
5	ESC	20A211T	Basic Electrical Engineering	3	0	0	3
Lab Courses							
6	ESC	20A511L	Problem Solving through C programming Lab	0	0	3	1.5
7	BSC	20AC12L	Applied Physics Lab	0	0	3	1.5
8	ESC	20A313L	Engineering & IT Workshop	0	0	3	1.5
						Total credits	19.5

Category	Credits
Basic Science Courses (BSC)	7.5
Engineering Science Courses (ESC)	12
Total Credits	**19.5**

Semester II (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	20AC21T	Differential equations and vector calculus	3	0	0	3
2	BSC	20AC23T	Chemistry	3	0	0	3
3	HSMC	20AC25T	Communicative English	3	0	0	3
4	ESC	20A221T	Electrical Circuits	3	0	0	3
5	ESC	20A222T	Fundamentals of Electronic Devices and Circuits	3	0	0	3
6	MC	20AC26T	Environmental Sciences	3	0	0	0
Lab Courses							
7	BSC	20AC23L	Chemistry Lab	0	0	3	1.5
8	ESC	20A222L	Fundamentals of Electronic Devices and Circuits Lab	0	0	3	1.5
9	HSMC	20AC25L	Communicative English Lab	0	0	3	1.5
						Total credits	19.5

Category	Credits
Basic Science Courses (BSC)	7.5
Engineering Science Courses (ESC)	7.5
Humanities and Social Sciences and Management Courses (HSMC)	4.5
Mandatory Courses (MC)	0
Total Credits	**19.5**

Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	20AC32T	Transform Techniques & Complex Variables	3	0	0	3
2	PCC	20A231T	Electrical Machines- I	3	0	0	3
3	PCC	20A232T	Network Analysis and Signals	3	0	0	3
4	PCC	20A233T	Analog Electronics	3	0	0	3
5	ESC	20A234T	Switching Theory & Logic Design	3	0	0	3
Lab Courses							
6	PCC	20A231L	Electrical Machines -I Lab	0	0	3	1.5
7	PCC	20A232L	Circuits Lab	0	0	3	1.5
8	ESC	20A233L	Electrical & Electronics Simulation Lab	0	0	3	1.5
9	SC	20A235L	PCB Design with EAGLE	1	0	2	2
10	SC	20A236L	MATLAB Programming				
			Total credits				21.5

Category	Credits
Basic Science Courses (BSC)	3
Program Core Courses (PCC)	12
Engineering Science Courses (ESC)	4.5
Skill Oriented Course (SC)	2
Total Credits	**21.5**

Semester IV (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	20AC42T	Numerical Methods and Random Variables	3	0	0	3
2	PCC	20A241T	Electrical Machines -II	3	0	0	3
3	PCC	20A242T	Electrical and Electronic Measurements	3	0	0	3
4	PCC	20A243T	Electromagnetic Fields	3	0	0	3
5	HSMC	20AC45T	Managerial Economics & Financial Analysis	3	0	0	3
6	MC	20AC44T	Life Sciences for Engineers	3	0	0	0
Lab Courses							
7	PCC	20A241L	Electrical Machines -II Lab	0	0	3	1.5
8	PCC	20A242L	Electrical Measurements Lab	0	0	3	1.5
9	PCC	20A244L	Analog Electronics Lab	0	0	3	1.5
10	SC	20A545L	Python Programming	1	0	2	2
			Total credits				21.5
Internship 2 Months (Mandatory) during summer vacation							

Category	Credits
Basic Science Courses (BSC)	3
Humanities and Social Sciences and Management Courses (HSMC)	3
Program Core Courses (PCC)	13.5
Skill Oriented Course (SC)	2
Total Credits	**21.5**

Semester V (Third year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PCC	20A251T	Linear Control Systems	3	0	0	3
2	PCC	20A252T	Power Electronics	3	0	0	3
3	PCC	20A253T	Electric Power Transmission and Switch gear	3	0	0	3
4	PEC-I	20A25AT	Distribution of Electrical power	3	0	0	3
		20A25BT	Electrical Machine Design				
		20A25CT	Instrumentation				
		20A25DT	Renewable Energy Systems				
5	OEC-I	20A15ET	Water Resources and Harvesting	3	0	0	3
		20A15FT	Disaster Management				
		20A35ET	Non-Conventional Sources of Energy				
		20A35FT	Industrial Management & Entrepreneurship				
		20A45DT	Electronic Circuits & its Applications				
		20A45ET	Introduction to Communication Systems				
		20A55FT	Data Structures using Python				
		20A55GT	Database Management System				
		20A305GT	Foundations of Artificial Intelligence and Data Science				
		20A305HT	Machine Learning				
		20AE5AT	Human Resource Management				
		20AE5BT	Intellectual Property Rights				
		20AC5AT	Literature and Life				
		20AC5BT	Linear Algebra and Numerical Analysis				
6	MC	20AC52T	Constitution of India	3	0	0	0
Lab Courses							
7	PCC	20A251L	Control Systems & Simulation Lab	0	0	3	1.5
8	PCC	20A252L	Power Electronics & Simulation Lab	0	0	3	1.5
9	SC	20AC51L	Professional Communication	1	0	2	2
10	PROJ.	20A254I	Summer Internship	0	0	0	1.5
Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester							
						Total credits	21.5
Internship 2 Months (Mandatory) during summer vacation							

Category	Credits
Program Core Courses (PCC)	12
Program Elective Courses (PEC)	3
Open Elective Courses (OEC)	3
Skill Advanced Course/ Soft Skill Course (SC)	2
Summer Internship	1.5
Total Credits	**21.5**

Semester VI (Third year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PCC	20A261T	Power System Analysis	3	0	0	3
2	PCC	20A262T	Microprocessors and Microcontrollers	3	0	0	3
3	PCC	20A263T	Power System Operation and Control	3	0	0	3
4	PEC-II	20A26AT	Power System Protection	3	0	0	3
		20A26BT	Power Semiconductor Drives				
		20A26CT	Modern control Theory				
		20A26DT	Solar and Wind Energy systems				
5	OEC-II	20A26ET	Open Elective-2(MOOCS)	3	0	0	3
6	MC	20AC63T	Essence of Indian Traditional Knowledge	3	0	0	0
Lab Courses							
7	PCC	20A261L	Power Systems Simulation Lab	0	0	3	1.5
8	PCC	20A262L	Microprocessors and Microcontrollers Lab	0	0	3	1.5
9	PCC	20A264L	Power Systems Lab	0	0	3	1.5
10	SC	20A564L	Java Programming	1	0	2	2
						Total credits	21.5
Industrial/Research Internship (Mandatory) 2 Months during summer vacation							

Category	Credits
Program Core Courses (PCC)	13.5
Program Elective Courses (PEC)	3
Open Elective Courses (OEC)	3
Skill Advanced Course/ Soft Skill Course (SC)	2
Mandatory Courses (MC)	0
Industrial/Research Internship (Mandatory) 2 Months	-
Total Credits	**21.5**

Semester VII (Fourth year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PEC-III	20A27AT	Restructured Power System	3	0	0	3
		20A27BT	HVDC & FACTS				
		20A27CT	Embedded Systems				
		20A27DT	Energy Auditing and Demand Side Management				
2	PEC-IV	20A27ET	High Voltage Engineering	3	0	0	3
		20A27FT	Hybrid Electric Vehicles				
		20A27GT	Programmable Logic Controller				
		20A27HT	Utilization of Electrical Energy				
3	PEC-V	20A27IT	Power Quality	3	0	0	3
		20A27JT	Special Electrical Machines				
		20A27KT	Introduction to Artificial Intelligence and Soft Computing				
		20A27LT	Energy Storage Systems				
4	OEC-III	20A27MT	Smart Grid	3	0	0	3
		20A27NT	IoT Applications in Electrical Engineering				
		20A27OT	Digital Signal Processing				
		20A27PT	System Modeling and Simulation				
5	OEC-IV	20A27QT	MOOCS-Interdisciplinary	3	0	0	3
6	HSMC	20AC71T	Universal Human Values II	3	0	0	3
7	SC	20A271L	IoT using Arduino and Node MCU	1	0	2	2
		20A272L	Simulation Studies on Power Electronics and Renewable Energy				
8	PROJ.	20A272I	Summer Internship	0	0	0	3
Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester)							
						Total credits	23

Category	Credits
Program Elective Courses (PEC)	9
Open Elective Courses (OEC)	6
Humanities and Social Sciences and Management Courses (HSMC)	3
Skill Advanced Course/ Soft Skill Course (SC)	2
Industrial/Research Internship	3
Total Credits	**23**

Semester VIII (Fourth year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PROJ	20A281P	Project Work	0	0	0	12
						Total credits	12

Track	PEC1	PEC2	PEC 3	PEC 4	PEC 5
PS	Distribution of Electrical Power	Power System Protection	Restructured Power System	High Voltage Engineering	Power Quality
PE&M	Electrical Machine Design	Power Semiconductor Drives	HVDC & FACTS	Hybrid Electric Vehicles	Special Electrical Machines
Control & Instrumentation	Instrumentation	Modern Control Theory	Embedded Systems	Program Logic Control	Introduction to Artificial Intelligence and soft computing
Energy Systems	Renewable Energy Systems	Solar and Wind Energy Systems	Energy Auditing and Demand Side Management	Utilization of Electrical Energy	Energy Storage Systems

Category	Credits
BSC	21
ESC	24
HSMC	10.5
PCC	51
PEC	15
OEC	12
Skill advanced course/ soft skill course	10
Industrial/Research Internship	4.5
PROJ	12
Total Credits	160

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Algebra and Calculus
Category	BSC
Course Code	20AC11T
Year	I
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra
- 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 Matrices 10

Rank of a matrix by echelon form, Normal form, Solving system of homogeneous and non-homogeneous linear equations, Eigen values and Eigen vectors and their properties.

Learning Outcomes: At the end of the unit, the student will be able to:

- Find the rank, Eigenvalues and Eigenvectors of a matrix (L1)
- solve systems of linear equations(L3)

Unit 2 Quadratic forms of matrices 8

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

Learning Outcomes: At the end of the unit, the student will be able to:

- apply Cayley-Hamilton theorem to find inverse and power of a matrix (L3)
- Identify special properties of matrix such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.(L3)

Unit 3 Mean Value Theorems & Multivariable calculus 10

Taylor's theorem and Maclaurin's theorem (without proofs) – Simple problems. Partial derivatives, total derivatives, chain rule, change of variables, Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers for three variables.

Learning Outcomes: At the end of the unit, the student will be able to:

- translate the given function as series of Taylor's and Maclaurin's(L2)
- find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies, and utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)
- acquire the Knowledge of maxima and minima of functions of several variables (L1)

Unit 4 Multiple Integrals 8

Double integrals, change of order of integration, change of variables (Cartesian to polar), areas enclosed by plane curves, evaluation of triple integrals.

Learning Outcomes: At the end of the unit, the student will be able to:

- extend the definite integral to double and triple integrals in cartesian and polar coordinates(L2)
- apply double integration techniques in evaluating areas bounded by region(L3)

Unit 5 Special Functions **8**

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of the unit, the student will be able to:

- understand the properties of beta and gamma functions and its relations(L2)
- utilize the special functions in evaluating definite integrals(L3)

Prescribed Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons,2011.

Reference Books:

1. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers,2013.
3. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
4. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of earning
1. Apply the knowledge to solve System of linear equations.	L3
2. Develop the use of matrix algebra techniques that is needed by engineers for practical applications	L3
3. Classify the functions of several variables which is useful in optimization	L4
4. Solve important tools of calculus in higher dimensions and be familiar with 2-dimensional, 3- dimensional coordinate systems	L3
5. Understand the properties of beta and gamma functions and its relations	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC11T.1	3	3	-	-	-	-	-	-	-	-	-	3	-	-
20AC11T.2	3	2	-	-	-	-	-	-	-	-	-	3	-	-
20AC11T.3	3	3	-	-	-	-	-	-	-	-	-	2	-	-
20AC11T.4	3	3	-	-	-	-	-	-	-	-	-	2	-	-
20AC11T.5	3	3	-	-	-	-	-	-	-	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course Applied Physics
Category BSC
Course Code 19AC12T

Year I
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- To impart knowledge in basic concepts of wave optics, electromagnetic theory and fiber optics.
- To explain the significant concepts of dielectrics, magnetic materials, semiconductors and superconductors in the field of engineering and their potential applications.
- To familiarize the applications of nano-materials relevant to engineering branches.

Unit 1 Wave Optics 9

Interference-Principle of Superposition-Interference of light- Conditions for sustained Interference -Interference in thin films (reflected light)-Newton's Rings-Determination of Wavelength- Engineering applications of interference.
Diffraction-Fraunhofer Diffraction-Single and double slit Diffraction -Diffraction Grating – Grating Spectrum - Determination of Wavelength-Engineering applications of diffraction.
Polarization-Polarization by double refraction-Nicol's Prism--Half wave and Quarter wave plate- Engineering applications of Polarization.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the need of coherent sources and conditions for sustained interference and illustrate the concept of polarization of light and its applications. (L2)
- Identify engineering applications of interference including homodyne and heterodyne detection. (L3)
- Analyze the differences between interference and diffraction and classify ordinary and extraordinary polarized light. (L4)

Unit 2 Dielectric and Magnetic materials 11

Introduction-Dielectric Polarization-Dielectric polarizability- Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic (quantitative), Orientation polarizations (qualitative) -Frequency dependence of polarization- Lorentz (internal) field - Claussius -Mosotti equation-Applications of Dielectrics – ferroelectricity.
Introduction- Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials-Weiss domain theory of ferromagnetism (qualitative)-Hysteresis-soft and hard magnetic materials-Magnetic device applications (Magnetic bubble memory).

Learning Outcomes:At the end of the unit, the student will be able to:
- Explain the concept of dielectric constant and polarization in dielectric materials. (L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence. (L2)
- Apply the concept of magnetism and magnetic devices. (L3)

Unit 3 Electromagnetic Waves and Fiber Optics 9

Divergence and Curl of Electric and Magnetic Fields-Gauss theorem for divergence and stoke's theorem for curl-Maxwell's Equations (quantitative)- Electromagnetic wave propagation (non-conducting medium)- Poynting's Theorem.
Introduction to Optical Fibers-Total Internal Reflection-Critical angle of propagation-Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile, modes (step index, Graded index optical fibers) – attenuation and losses in optical fibers-Block diagram of fiber optic communication- Medical

Applications-Fiber optic Sensors.

Learning Outcomes: At the end of the unit, the student will be able to:

- Apply the Gauss' theorem for divergence and Stoke's theorem for curl. (L3)
- Apply electromagnetic wave propagation in different guided media. (L3)
- classify optical fibers based on refractive index profile and mode of propagation and identify the applications of optical fibers in medical,communication and other fields.(L2)

Unit 4 Semiconductors 8

Origin of energy bands - Classification of solids based on energy bands – Intrinsic semiconductors - density of charge carriers-Fermi energy – Electrical conductivity - extrinsic semiconductors - P-type & N-type - Density of charge carriers - Dependence of Fermi energy on carrier concentration and temperature- Direct and Indirect band gap semiconductors-Hall effect- Hall coefficient - Applications of Hall effect - Drift and Diffusion currents – Einstein's relation - Applications of Semiconductors.

Learning Outcomes: At the end of the unit, the student will be able to:

- Outline the properties of n-type and p-type semiconductors and charge carriers. (L2)
- Interpret the direct and indirect band gap in semiconductors. (L2)
- Identify the type of semiconductor using Hall effect. (L2)

Unit 5 Superconductors and Nano materials 8

Superconductors-Properties- Meissner's effect - Types of Superconductors - BCS Theory-Josephson effect (AC & DC)- Applications of superconductors.

Nano materials – significance of nanoscale - properties of nanomaterials: physical, mechanical, magnetic, Optical, Thermal - synthesis of nanomaterials: top-down - ball milling- Bottom-up - Chemical vapor deposition-characterization of nanomaterials: X-ray diffraction (XRD)- Scanning Electron Microscope (SEM) - Applications of Nano materials.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain how electrical resistivity of solids changes with temperature. (L2)
- Classify superconductors based on Meissner's effect. (L2)
- Apply the basic properties of nano-materials in various engineering branches. (L3)

Prescribed Textbooks:

1. M.N. Avadhanulu, P.G.Kshirsagar& T. V. S. Arunmurthy, A Textbook of Engineering Physics, S.Chand Publications,11th edition,2019
2. T Pradeep, A textbook of Nano Science and Nano Technology, Tata McGrawHill, 2013
3. Charles Kittel, Introduction to Solid State Physics, Wiley Publications,2011

Reference Books:

1. David J.Griffiths, Introduction to Electrodynamics, 4/e, Pearson Education,2014
2. K. Thyagarajan, Applied Physics, McGraw Hill Education (India) Private Ltd, 2019
3. Gerd Keiser, Optical Fiber Communications, 4/e, Tata McGraw Hill,2008

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Explainthe concepts of interference, diffraction and polarization andidentifytheir applications in engineering field.	L2
2. Summarizethe various types of polarization of dielectrics**,** classification of magnetic materialsand the applications of dielectric and magnetic materials.	L2
3. Applyelectromagnetic wave propagation in different guided media and Explain fiber optics concepts in various fields with working principle.	L3
4. outline the properties of various types of semiconductors and identify the behavior of semiconductors in various fields	L2
5. Explain various concepts of superconductors and nano-materials with their applications in various engineering branches.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC12T.1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
20AC12T.2	3	2	2	-	-	-	-	-	-	-	-	2	-	-
20AC12T.3	3	2	2	-	-	-	-	-	-	-	-	2	-	-
20AC12T.4	3	1		-	-	-	-	-	-	-	-	-	-	-
20AC12T.5	3	2	2	-	-	-	-	-	-	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course Problem Solving through C programming
Category ESC
Course Code 20A511T

Year I
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- Understanding the steps in problem solving and formulation of algorithms to problems.
- Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
- Develop intuition to enable students to come up with creative approaches to problems.
- Develop programs using pointers, structures and unions
- Manipulation of text data using files

Unit 1 Problem Solving and Introduction to C 9

Steps to solve problems, algorithm, Pseudo code, Flowchart with examples, Program Development Environments. Introduction to programming: Programming languages and generations.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, data types, constants, I/O statements, operators, precedence and associatively.

Learning Outcomes: At the end of theunit, the student will be able to:
- Identify situations where computational methods and computers would be useful. (L2)
- Approach the programming tasks using techniques learned and write pseudo-code.(L2)
- Choose the right data representation formats based on the requirements of the problem. (L3)
- Write the program on a computer, edit, compile, debug, correct, recompile and run it.(L4)

Unit 2 Introduction to decision control statements and Arrays 9

Selective, looping and nested statements, jumping statements.

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, searching (linear and binary search algorithms) and sorting (selection and bubble) algorithms, multidimensional arrays, matrix operations.

Learning Outcomes: At the end of theunit, the student will be able to:
- Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.(L3)
- Identify tasks in arrays with different techniques that are applicable and apply them to write programs. (L2)
- Design and implement operations on both single and Multidimensional arrays. (L4)

Unit 3 Strings and Functions 9

Strings: Declaration and Initialization, String Input / Output functions, String manipulation functions. **Functions:** Types of functions, recursion, scope of variables and storage classes.

Preprocessor Directives: Types of preprocessor directives, examples.

Learning Outcomes: At the end of the unit, the student will be able to:
- Implement and test the programs on strings using string manipulation functions. (L5)
- Analyze programming problems to choose when regular loops should be used and when recursion will produce a better program (L4)

Unit 4 Pointers 9

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer

arithmetic, pointers and strings, array of pointers, function pointers, dynamic memory allocation, advantages and drawbacks of pointers.

Learning Outcomes: At the end of the unit, the student will be able to:

- Identify tasks in which the dynamic memory allocation techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task. (L2)
- Design and develop Computer programs, analyzes, and interprets the concept of pointers and their usage. (L6)

Unit 5 Structures and Files 9

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, array of structures, structures and functions, structures and pointers, self-referential structures, unions and enumerated data types.

Files: Introduction to files, file operations, reading and writing data on files, error handling during file operations.

Learning Outcomes: At the end of the unit, the student will be able to:

- Define derived data types and use them in simple data processing applications. (L2)
- Develop and test C programs for simple applications using files. (L5)

Prescribed Text Books:

1. C Programming and Data Structures. B.A. Forouzan, R. F.Gilberg, Cengage learning, Indian edition.
2. C and Data Structures, E.Balaguruswamy, Tata McGraw Hill.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.

Reference Books:

1. LET US C, YeswanthKanitkar, Ninth Edition, BPB Publication
2. Byron Gottfried, Schaum's" Outline of Programming with C", McGraw-Hill.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
4. A K Sharma "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018.
5. PradeepDey and Manas Ghosh, "Programming in C", Oxford Press, 2ndEdition, 2017
6. ReemaTharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Formulate solutions to problems and represent those using algorithms/Flowcharts.	L3
2. Choose proper control statements and use arrays for solving problems.	L3
3. Decompose a problem into modules and use functions to implement the modules.	L4
4. Apply and use allocation of memory for pointers and solve the problems related to manipulation of text data using files and structures.	L3
5. Develop the solutions for problems using C programming Language.	L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A511T.1	1	2	2	3	-	1	-	-	-	-	-	-	3	-
20A511T.2	3	3	3	3	3	-	-	-	1	-	-	-	3	-
20A511T.3	3	2	1	2	1	-	-	-	1	-	-	2	3	-
20A511T.4	2	3	2	2	3	-	-	-	1	-	1	2	3	-
20A511T.5	3	2	2	2	2	-	-	-	1	-	-	2	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course Engineering Drawing
Category ESC
Course Code 20A312T

Year I
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
1	0	4	3

Course Objectives:

- To bring awareness that Engineering Drawing is the Language of Engineers.
- To familiarize how industry communicates technical information.
- To teach the practices for accuracy and clarity in presenting the technical information.
- To develop the engineering imagination essential for successful design.
- To provide the basic geometrical information to ignite the innovative design ideas.

Unit 1 Introduction to Drawing and Engineering Curves. Theory Hours: 05
Practice sessions: 04

Introduction: Lettering–Geometrical Constructions- Construction of polygons by General method.
Conics: Ellipse, Parabola and Hyperbola (General method only). Special Methods: Ellipse - Concentric Circles method, Oblong method & Arcs of Circles method - Drawing tangent & normal to the conics.
Cycloidal Curves: Cycloid, Epi-cycloid, Hypo-cycloid (simple problems) - Drawing tangent & normal to the Cycloidal curves

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Learning Outcomes : At the end of the unit, the student will be able to

- Understand the significance of engineering drawing and understand the geometrical constructions, conventions used in the engineering drawing.(L2)
- Identify the curves obtained in different conic sections and able to draw different conic curves. (L1)
- Know and draw the different Cycloidal curves, also its practical application in engineering. (L1)

Unit 2 Projections of Points and Lines. Theory Hours: 03
Practice sessions: 06

Projections of points - Projections of lines inclined to one reference plane, Projections of lines inclined to both reference planes. True lengths and Traces of lines (simple problems).

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the principles and elements of projection. (L2)
- Know how to draw the projections of points, lines. (L1)
- Differentiate between projected length and true length and also find the true length of the lines. (L1)

Unit 3 Projections of Planes. Theory Hours: 05
Practice sessions: 04

Projection of planes inclined to one reference plane - and inclined to both the reference planes.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the projections of different geometrical regular plane surfaces. (L2)
- Identify and Construct the true shapes of the plane surfaces. (L1)
- Analyze the projections of plane surface inclined to both the planes. (L4)

Unit 4 Projections of Solids. **Theory Hours: 05**
Practice sessions: 04

Projections Of simple Solids such as Cylinder, Cone, Prism and Pyramid - Axis Inclined to one reference plane, Axis inclined to both the referenceplanes

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand different types of solids. (L2)
- Draw projection of simple solids. (L3)
- Draw the Projections of solids inclined to both the reference planes. (L3)

Unit 5 Isometric Projections & Conversion of Views. **Theory Hours: 04**
Practice sessions: 05

Isometric Projections: Projections of Lines, Planes and Simple Solids – Prism, Pyramid, Cylinder and Cone in simple positions only.

Conversion of Views: Conversions of Orthographic views in to Isometric views and Conversion of Isometric views to Orthographic views.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the pictorial views such as isometric views, orthographic views and also differentiate between Isometric Projection and View. (L2)
- Draw the Isometric views of simple plane surfaces and simple solids. (L3)
- Draw the conversions of Isometric Views in to Orthographic Views and Vice-versa. (L3)

Prescribed Text Books:

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers, Edition2016
2. Engineering Drawing, K.L. Narayana, P. Kanniah, Scitech Pub, Edi2016

Reference Books:

1. Engineering Drawing and Graphics, Venugopal/ New age, Ed2015.
2. Engineering Drawing, Johle, Tata McGraw-Hill. Ed2014
3. Engineering Drawing, Shah and Rana, 2/e, Pearson Education Ed2015

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the concepts of Conic Sections.	L1, L2
2. Understand the concept of Cycloidal Curves, Involutes and the application of industry standards.	L1, L2
3. Understand the Orthographic Projections of Points and Lines and are capable to improve their visualization skills, so that they can apply these skills in developing the new products.	L1, L2, L4
4. Understand and apply Orthographic Projections of Planes.	L2, L3
5. Understand and analyze the Orthographic Projections of Solids and conversion of isometric views to orthographic views vice-versa.	L2, L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A312T.1	3	-	-	-	-	3	2	-	1	2	-	-	-	-
20A312T.2	3	-	-	-	-	3	2	-	1	2	-	-	-	-
20A312T.3	3	2	-	-	-	3	2	-	1	2	-	-	-	-
20A312T.4	3	2	-	-	-	3	2	-	1	2	-	-	-	-
20A312T.5	3	-	2	-	2	2	-	3	3	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Basic Electrical Engineering
Category ESC
Course Code 20A211T

Year I
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- Understand the fundamental laws and circuit elements
- Analyze the DC circuits.
- Know the various measuring instruments and electrical installations
- Understand the conventional power generation methods
- Understand the solar and wind power generation methods

Unit 1 Fundamental Laws and Circuit Elements 9

Voltage, current, power, energy, charge, flux, emf ,static and dynamic emf, classification of magnets: permanent magnets and electro magnets, magnetic leakage, magnetic hysteresis, B-H curve, residual magnetism, Faraday's laws of electromagnetic induction, Fleming's right hand rule, Fleming's left hand rule, Lenz's law, Cork screw rule, Right hand thumb rule, Right hand palm rule.

Electrical circuit elements (R, L and C), Ohm's law, v-i relationships, classification of elements, voltage and current sources.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the fundamental laws of Electrical Engineering.(L1)
- Know the electrical circuit elements and their v-I relationships.(L1)
- Know the electrical sources.(L1)

Unit 2 Analysis of DC Circuits 9

Network reduction techniques - series, parallel, star-delta transformation, Kirchhoff's current and voltage law, voltage division, current division, source transformation, analysis of simple circuits with dc excitation (Independent sources only).

Learning Outcomes: At the end of the unit, the student will be able to:

- understand the network reduction techniques(L1)
- understand the Kirchhoff's laws(L1)
- solve the electrical circuits with dc excitation(L3)

Unit 3 Measuring Instruments and Electrical Installations 9

Introduction, Electrical and Electronic Instruments, Classification of Instruments, Multimeter, Function generator, Oscilloscope - Frequency Measurement, Phase Measurement.

Switch Fuse Unit (SFU), MCB, types of wires and cables, earthing, elementary calculations for energy consumption.

Learning Outcomes: At the end of the unit, the student will be able to:

- Know the types of measuring instruments.(L1)
- Understand the construction and operation of measuring instruments.(L1)
- know the various electrical installations.(L1)

Unit 4 Conventional Power Generation 9

Evolution of Power System and Present-Day Scenario. Structure of a power system,Thermal power station-layout and working principle, hydro power station, layout and working principle, Nuclear power station layout and

working principle Nuclear Fission and Chain Reaction- Nuclear Fuels- Principle of Operation of Nuclear Reactor.

Learning Outcomes: At the end of the unit, the student will be able to:

- know the evolution of power system and present-day scenario(L1)
- Understand the conventional power generation methods.(L1)

Unit 5 Solar and Wind Power Generation 9

Solar power generation - principle of solar Radiation, PV Cell, v-I characteristics, wind power Generation - construction of typical wind turbine - horizontal and vertical axis wind turbines.

Learning Outcomes : At the end of the unit, the student will be able to

- understand the electrical power generation using solar and wind power(L1)

Prescribed Text Books/ References:

1. D.P.Kothari and I.J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D.C.Kulshreshta, "Basic Electrical Engineering", McGraw Hill, 2009.
3. P.S.Dhogal, "Basic Electrical Engineering with Numerical Problems" McGraw Hill
4. S.Salivahanan, N,Suresh Kumar, "Electronic Devices and Circuits" McGraw Hill, 2011.
5. A.Sudhakar and Shyammohan S Palli, "Circuits and Networks" McGraw Hill, 2018.
6. C.L Wadhwa, "Electric Power Generation,Distribution and Utilization", NewAge Inter. (P) Ltd., 2005.
7. G.D. Rai, "Non- Conventional Energy Sources", Khanna Publishers, 2000.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the fundamental laws and circuit elements	L2
2. Analyze the DC circuits.	L4
3. know the various measuring instruments and electrical installations	L2
4. Understand the conventional power generation methods	L2
5. Understand the solar and wind power generation methods	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A211T.1	1	1	-	-	-	-	-	-	-	-	-	-	1	-
20A211T.2	1	1	-	-	-	-	-	-	-	-	-	-	1	-
20A211T.3	-	-	1	-	-	1	-	-	-	-	-	-	-	-
20A211T.4	-	-	-	-	-	-	1	-	-	-	-	-	-	1
20A211T.5	-	-	-	-	-	-	1	-	-	-	-	-	-	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Problem Solving through C Programming Lab
Category	ESC
Course Code	20A511L

Year	I
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

- Setting up programming environment.
- Develop Programming skills to solve problems.
- Use of appropriate C programming constructs to implement algorithms.
- Identification and rectification of coding errors in program
- Develop applications using a modular programming and Manage data using files.

Minimum number of FOUR programs from each exercise is to be done students

Data Types, Constants, Input and Output and expressions

Exercise 1: Data types, Variables, Constants and Input and Output.
Exercise 2: Operators, Expressions and Type Conversions.

Learning Outcomes: At the end of this module, the student will be able to:

- Identify situations where computational methods and computers would be useful. (L2)
- Approach the programming tasks using techniques learned and write pseudo-code. (L2)
- Write the program on a computer, edit, compile, debug, correct, recompile and run it. (L4)

Decision Control Statements and Arrays

Exercise 3: Conditional Statements [two way and multipath].
Exercise 4: Loop Control Statements. [for, while and do-While]
Exercise 5: Unconditioned JUMP Statements- break, continue, goto.
Exercise 6: Declaring Arrays, Referencing Arrays, Array Subscripts. Using for loop for sequential Access.
Exercise 7: Multidimensional Arrays

Learning Outcomes: At the end of this module, the student will be able to:

- Choose the right data representation formats based on the requirements of the problem. (L3)
- Use the comparisons and limitations of the various programming constructs and choosethe right one for the task in hand. (L3)
- Identify tasks in arrays with different techniques that are applicable and apply them to write programs. (L2)
- Design and implement operations on both single and Multidimensional arrays. (L6)

Strings and Functions

Exercise 8: String Basics, String Library Functions and Array of Strings.
Exercise 9: Simple user defined functions, Parameter passing methods- pass by value, pass by reference.
Exercise 10: Storage classes- Auto, Register, Static and Extern
Exercise 11: Recursive Functions, Preprocessor commands.
Exercise 12: Array Elements as Function Arguments.

Learning Outcomes: At the end of this module, the student will be able to:

- Implement and test the programs on strings using string manipulation functions. (L5)
- Analyze programming problems to choose when regular loops should be used and when recursion will produce a better program (L4)

Pointers

Exercise 13: Pointers, Dynamic memory allocation and error handling

Learning Outcomes: At the end of this module, the student will be able to:

- Design and develop Computer programs, analyzes, and interprets the concept of pointers and their usage. (L6)
- Identify tasks in which the dynamic memory allocation techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task. (L2)

Structures and Files

Exercise 14: Structures

Exercise 15: File handling

Learning Outcomes:

At the end of this module, the student will be able to:

- Define structure data types and use them in simple data processing applications. (L2)
- Develop and test C programs for simple applications using files. (L6)

Prescribed Text Books:

1. C Programming and Data Structures. B.A. Forouzan, R. F.Gilberg,Cengage learning, Indian edition.
2. C and Data Structures, E.Balaguruswamy, Tata McGraw Hill.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.

Reference Books:

1. Let Us C, YeswanthKanitkar, Ninth Edition, BPB Publication
2. A K Sharma "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018.
3. PradeepDey and Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017
4. ReemaTharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015
5. https://www.cprogramming.com/
6. https://www.mycplus.com/tutorials/c-programming-tutorials

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Identify and setup program development environment	L2
2. Implement the algorithms using C programming language constructs	L5
3. Identify and rectify the syntax errors and debug program for semantic errors	L3
4. Solve problems in a modular approach using functions	L5
5. Implement file operations with simple text data	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A511L.1	3	2	-	2	2	-	-	-	2	2	1	-	3	-
20A511L.2	2	2	-	-	-	-	-	-	1	-	-	-	3	-
20A511L.3	3	3	3	3	-	-	-	-	1	-	-	3	3	-
20A511L.4	3	3	3	3	-	-	-	-	-	-	-	3	3	-
20A511L.5	3	3	3	3	-	-	-	-	-	-	-	3	3	-

ANNAMACHRYA INSTITUTE OF TECHNOLOGY AND SCIENCES
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Applied Physics Lab
Category BSC
Course Code 20AC12L

Year I
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

- Learn the concepts of interference , diffraction and their applications and the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and hall effect in a semiconductor.
- Know about the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

List of Experiments

1. Determination of the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of Dispersive power of a diffraction grating
5. Determination of Resolving power of a grating
6. Determination of dielectric constant by charging and discharging method.
7. Determination of Magnetic field along the axis of a circular coil carrying current.
8. Determination of the self inductance of the coil (L) using Anderson's bridge.
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
10. Determination of the numerical aperture of a given optical fiber and hence to find its acceptance angle.
11. Measurement of magnetic susceptibility by Gouy's method
12. Determination of Hall voltage and Hall coefficient of a given semiconductor usingHall effect.
13. Determination of the resistivity of semiconductor by Four probe method
14. Determination of the energy gap of a semiconductor
15. Measurement of resistance with varying temperature.

References:

1. S. Balasubramanian, M.N. Srinivasan A Text book of Practical Physics, S ChandPublishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Outcomes: Blooms Level of Learning

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

1. Operate various optical instruments and estimate various optical parameters. L3
2. Estimate the various magnetic properties. L4
3. Measure properties of semiconductors. L4 & L5
4. Determine the properties of dielectric materials and optical fiber materials. L5

CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC12L.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
20AC12L.2	3	1	-	-	2	-	-	-	-	-	-	-	-	-
20AC12L.3	2	-	-	-	2	-	-	-	-	-	-	-	-	-
20AC12L.4	3	2	-	-	2	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Engineering & IT Workshop
Category	ESC
Course Code	20A313L
Year	I
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

- To read and interpret job drawing, plan various operations and make assembly.
- To identify and select the hand tools and instruments used in various trades.
- To gain practical skills by performing the experiments in different trades of workshop.
- Demonstrate the parts of a personal computer system
- Demonstrate the Installation the operating system and other software required in a personal computer system
- Introduce connecting the PC on to the internet from home and workplace and effectively usage of the internet, Usage of web browsers, email, news groups and discussion forums
- Introduce the usage of Productivity tools in crafting professional word documents, excel spreadsheets and power point presentations
- To utilize MS Office tools

Engineering Workshop:

Trade 1 Carpentry Shop 02

Two joints (exercises) from : Mortise and tenon T joint, Dove tail joint, Bridle T joint, middle lap T joint, Half Lap joint, cross lap joint, Corner Dovetail joint or Bridle Joint from soft wood stock.

Learning Outcomes:At the end of the unit, the student will be able to:

- Apply wood working skills in real world applications. (L3)

Trade 2 Sheet metal shop 02

Two jobs (exercises) from: Tapered Tray, cylinder, conical funnel from out of 22 or 20 gauge G.I. sheet

Learning Outcomes:At the end of the unit, the student will be able to:

- Build different parts with metal sheets used in various appliances (L3)

Trade 3 Fitting shop 02

Two jobs (exercises) from: square Fit, V-Fit, Semi-circular fit, dove tail fit from M.S. stock

Learning Outcomes: At the end of the unit, the student will be able to :

- Apply fitting operations in various assemblies. (L3)

Trade 4 House-wiring 02

Two jobs (exercises) from: Parallel and Series, Two way switch, Tube –Light connection, Stair case connection.

Learning Outcomes: At the end of the unit, the student will be able to:

- Apply basic electrical engineering knowledge for house wiring practice. (L3)

Trade 5 Demonstration 01

Any one trade of Plumbing • Machine Shop • Metal Cutting • Soldering and Brazing

Learning Outcomes: At the end of the unit, the student will be able to:

- Get the basic awareness of any of trade demonstrated. (L3)

Prescribed Text Books:

1. Kannaiah P. and Narayana K.L., Workshop Manual, 3rd Edn, Scitech publishers.
2. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.

Reference Books:

1. Jeyapoovan T and Pranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.

IT Workshop:

Task 1 **01**

Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report

Learning Outcomes: At the end of the unit, the student will be able to:

- Identify the parts of a computer (L2)
- Know the usage of internal parts of a computer (L2)

Task 2 **01**

Install Operating System: Student should install Linux on the computer. Students should record the entire installation process.

Learning Outcomes: At the end of the unit, the student will be able to:

- Install another operating systems (L1)
- Know how to install software's (L2)

Task 3 **01**

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Face book, Skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

Learning Outcomes: At the end of the unit, the student will be able to:

- Create e-mail account and send email (L2)
- Browse internet for required information (L2)

Task 4 **01**

Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered. .

Learning Outcomes: At the end of the unit, the student will be able to:

- Prepare project documents, user manuals (L3)
- Get the knowledge on word processor tool (L1)

Task 5 **01**

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

Learning Outcomes: At the end of the unit, the student will be able to:

- Create , open and save spread sheets (L3)
- Apply formulas for different tasks (L4)

01

Task 6

Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyper linking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

Learning Outcomes: At the end of the unit, the student will be able to:

- Create , open and save slides (L4)
- Create their own presentations for seminars (L4)

Prescribed Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. Upgrading and Repairing PC's, 22nd Edition, Scott Muller QUE, Pearson Education.
3. Comdex Information Technology Course Kit, Vikas Gupta, WILEY Dream tech.
4. MOS 2010 Study Guide for Microsoft Word, Excel, PowerPoint, and Outlook Exams, 1st Edition, Joan Lambert, Joyce Cox, Microsoft Press

Reference Books:

1. IT Essentials PC Hardware and Software Companion Guide, CICSO Networking Academy
2. Network Your Computer & Devices Step by Step 1st Edition, Ciprian Rusen, Microsoft Press
3. Troubleshooting, Maintaining & Repairing PCs, 5th Edition, Bigelow, TMH
4. Introduction to computers, Peter Norton, 6/e, Mc Graw Hill

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Apply wood working skills in real world applications.	L3
2. Build different parts with metal sheets used in various appliances.	L3
3. Employ fitting operations in various assemblies.	L3
4. Execute basic electrical engineering knowledge for house wiring practice.	L3
5. Identify various operations and its applications from the demonstration.	L3
6. Recognize the peripherals of a computer, perform assembling and disassembling of various components of a computer.	L1, L3
7. Describe and perform installation and un-installation of Windows and Linux operating systems and also perform troubleshooting of various hardware and software components.	L2, L3
8. Use Web browsers to access Internet, Search Engines.	L3
9. Use word processor; spread sheet, presentation and data storage tools.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A313L.1	3	-	1	-	1	-	-	-	-	-	-	1	-	-
20A313L.2	3	-	1	-	1	-	-	-	-	-	-	1	-	-
20A313L.3	3	-	1	-	1	-	-	-	-	-	-	1	-	-
20A313L.4	2	-	1	-	1	-	-	-	-	-	-	1	-	-
20A313L.5	3	-	1	-	1	-	-	-	-	-	-	1	-	-
20A313L.6	3	3	1	-	3	-	-	-	-	-	-	3	2	-
20A313L.7	3	3	1	-	3	-	-	-	-	-	-	3	2	-
20A313L.8	3	3	1	-	3	-	-	-	-	-	-	3	2	-
20A313L.9	3	3	1	-	3	-	-	-	-	-	-	3	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Differential Equations and Vector Calculus
Category	BSC
Course Code	20AC21T
Year	I
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real worldapplications.

Unit 1 Linear differential equations of higher order with constant Coefficients 10

Basic concepts - general solution-operator D-rules for finding complimentary function-inverse operator-rules for finding particularintegral for RHS term of the type e^{ax}, $\sin ax / \cos ax$, polynomials in x, $e^{ax}\sin ax / e^{ax}\cos ax / e^{ax}x^n, x\sin ax / x\cos ax$ -method of variation of parameters.

Learning Outcomes: At the end of the unit, the student will be able to
- Identify the essential characteristics of linear differential equations with constant coefficients(L3)
- Solve the linear differential equations with constant coefficients by appropriate method (L3)

Unit 2 Equations reducible to Linear Differential Equations with constant coefficients 8

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients
Applications**:** Electrical Circuits – L-C and L-C-R Circuit problems.

Learning Outcomes:At the end of the unit, the student will be able to
- Classify and interpret the solutions of linear differential equations(L4)
- Generalize and solve the higher order differential equation by analyzing physical situations(L3)

Unit 3 Partial Differential Equations 8

Formation of PDEs by eliminating arbitrary constants and arbitrary functions, solutions of first order linear and non-linear PDEs (Charpit's method). Introduction to method of separation of variables for second order linear Partial Differential Equations.

Learning Outcomes: At the end of the unit, the student will be able to
- Apply the techniques to find solutions of standard PDEs (L3)
- Solve the boundary value problems (L3)

Unit 4 Vector Differentiation 8

Scalar and vector point functions, vector operator Del, Gradient, Divergence and Curl operators, and vector identities.

Learning Outcomes: At the end of the unit, the student will be able to
- Apply del to scalar and vector point functions(L3)
- Illustrate the physical interpretation of Gradient, Divergence and Curl(L2)

Unit 5 Vector integration 10

Line integral-circulation-work done, surface integral, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Learning Outcomes: At the end of the unit, the student will be able to

- Find the work done in moving a particle along the path over a force field(L1)
- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals(L3)

Prescribed Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

Reference Books:

1. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. R.L. GargNishuGupta, Engineering Mathematics Volumes-I &II, PearsonEducation
4. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S.Chand.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Solve the differential equations related to various engineering fields	L3
2. Generalize and solve the higher order differential equation by analyzing physical situations	L3
3. Identify solution methods for partial differential equations that model physical processes	L3
4. Understand the physical meaning of different operators such as gradient, curl and divergence	L2
5. Find the work done against a field, circulation and flux using vector calculus	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC21T.1	3	3	-	-	-	-	-	-	-	-	-	2	-	-
20AC21T.2	3	3	-	-	-	-	-	-	-	-	-	2	-	-
20AC21T. 3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
20AC21T.4	3	3	-	-	-	-	-	-	-	-	-	2	-	-
20AC21T.5	3	3	-	-	-	-	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Chemistry
Category	BSC
Course Code	20AC23T
Year	I
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To instruct electrode potential and differentiation of different electrodes and their applications.
- To impart knowledge on the basic concepts of battery technology.
- To explain how to synthesize different polymers and differentiate polymers based on properties.
- To introduce different types of instrumental techniques and molecular machines and molecular switches.

Unit 1 Electrochemical Energy Systems - I **10**

Introduction- Electrochemical Cell, Galvanic Cell vs. Electrolytic Cell, Electrochemical conventions. Origin of electrode potential, Electrode Potentials, Measurement of Electrode Potentials, Nernst Equation for a single electrode, EMF of a cell. Types of Electrodes or Half Cells-Hydrogen and Calomel electrodes. Types of Ion Selective Electrodes- glass membrane electrode, polymer membrane electrodes, solid state electrodes, gas sensing electrodes (classification only)

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the construction of different Ion selective electrodes (L2)
- Solve problems based on cell potential and EMF(L3)
- Apply Nernst equation for calculating electrode and cell potentials (L3)

Unit 2 Electrochemical Energy Systems - II **10**

Basic concepts of batteries, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries-zinc air, lithium cells-Li MnO_2 cell- challenges of battery technology. Fuel cells - Introduction - classification of fuel cells – Hydrogen and Oxygen fuel cell, propane and oxygen fuel cell - Merits of fuel cells.

Learning Outcomes:At the end of the unit, the student will be able to:

- Explain the theory of construction of battery and fuel cells (L2)
- Describe the working principle of Fuel cells (L2)
- Summarize the applications of batteries (L4)

Unit 3 Polymer Chemistry **10**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of Bakelite, urea-formaldehyde, Nylon-6,6. Elastomers Preparation, properties, and applications of Buna-S, Buna-N. Conducting polymers – polyacetylene, polyaniline – mechanism of conduction and applications

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the preparation, properties and applications of Bakelite, and Nylon-6,6 (L2)
- Illustrate the mechanism of conduction in polyacetylene and polyaniline (L3)
- Discuss Buna-S and Buna-N elastomers and their applications (L2)

Unit 4 Instrumental Methods and their Applications **9**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law.
Principle and applications of pH metry, Potentiometry, Conductometry, UV-Visible, IR Spectroscopy, Gas Chromatography (GC) Thin layer chromatography(TLC)

Learning Outcomes: At the end of the unit, the student will be able to:

- Distinguish the ranges of different types of spectral series in electromagnetic spectrum (L4)
- Understand the principles of different analytical instruments (L2)
- Differentiate between pH metry, potentiometry and conductometry (L4)

Unit 5 Molecular Machines & Switches **10**

Molecular machines: Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor, systems based on Catenanes.
Molecular switches – Introduction to molecular switches, Cyclodextrin-based switches, in and out switching, back and forth switching, displacement switching

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the mechanism involved in linear motion of Rotaxanes (L2)
- Explain different types of switching in Cyclodextrins (L4)
- Demonstrate the applications of Rotaxanes and Catenanes as artificial molecular machines (L2)

Prescribed Textbooks:

1. O.G.Palanna, Engineering Chemistry, 2/e, Tata McGraw Hill Education Private Limited, 2017.
2. P.C. Jain and M. Jain, Engineering Chemistry, 17/e, DhanpatRai& Sons, 2018

Reference Books:

1. Shashi Chawla, A textbook of Engineering chemistry, 3/e, DhanpatRai& Co, 2015.
2. Skoog, Holler, Crouch, Principles of Instrumental Analysis, 7/e, Cengage learning, 2018.
3. T. Ross Kelly, Molecular Machines, 1/e, Springer Berlin Heidelberg, 2005
4. Ben L. Feringa, Wesley R. Browne, Molecular Switches, 2/e, Wiley, 2011

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Explain the significance of electrode potentials, classify ion selective electrodes, and list different types of electrodes	L2
2. Compare variousbatteries, explain the concepts involved in the construction of lithium cells, different fuel cells and apply redox principles for construction of batteries and fuel cells.	L4
3. Illustrate the mechanism of conduction in conducting polymers, and explain the preparation, properties, and applications of various polymers	L3
4. Differentiate various analytical techniques	L4
5. Compare molecular switches and molecular machines, and distinguish between molecular machines	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC23T .1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
20AC23T .2	3	2	-	-	-	-	-	-	-	-	-	2	-	-
20AC23T .3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
20AC23T .4	3	2	-	-	-	-	-	-	-	-	-	2	-	-
20AC23T .5	3	2	-	-	-	-	-	-	-	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Communicative English
Category HSMC
Course Code 20AC25T

Year I
Semester II
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- To facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- To focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- To Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- To impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays
- To provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Unit 1 **9**

Prescribed Lesson: On the Conduct of Life by William Hazlitt

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: Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Learning Outcomes

At the end of this unit, the student will be able to:
- Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information (L1)
- Ask and answer general questions on familiar topics and introduce oneself/others (L2)
- Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information (L3)
- Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs (L2)
- Form sentences using proper grammatical structures and correct word forms (L4)

Unit 2 **9**

Prescribed Lesson:The Brook by Alfred Tennyson

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, signposts and transition signals; use of articles and zero article; prepositions.

Learning Outcomes

At the end of this unit, the student will be able to :

- Comprehend short talks on general topics (L1)
- Participate in informal discussions and speak clearly on a specific topic using suitable discourse markers (L3)
- Understand the use of cohesive devices for better reading comprehension (L1)
- Write well-structured paragraphs on specific topics (L4)
- Identify basic errors of grammar/ usage and make necessary corrections in short texts (L2)

Unit 3 **9**

Prescribed Lesson:The Death Trap by Saki

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, Paragraph Writing, 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.

Learning Outcomes

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

- Comprehend short talks and summarize the content with clarity and precision (L1)
- Participate in informal discussions and report what is discussed (L3)
- Infer meanings of unfamiliar words using contextual clues (L3)
- Write summaries based on global comprehension of reading/listening texts (L4)
- Use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing(L4)

Unit 4 **9**

Prescribed Lesson:Muhammad Yunus

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: Writing structured essays on specific topics using suitable claims and evidence.

Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice

Learning Outcomes

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

- Infer and predict about content of spoken discourse (L2)
- Understand verbal and non-verbal features of communication and hold formal/informal conversations (L1)
- Interpret graphic elements used in academic texts (L3)
- Produce a coherent paragraph interpreting a figure/graph/chart/table (L4)
- Use language appropriate for description and interpretation of graphical elements (L3)

Unit 5 **9**

Prescribed Lesson: The Dancer with a White Parasol by Ranjana Deve

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: Letter Writing: Official Letters/Report Writing

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

Learning Outcomes

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

- Take notes while listening to a talk/lecture and make use of them to answer questions (L4)
- Make formal oral presentations using effective strategies (L4)
- Comprehend, discuss, and respond to academic texts orally and in writing. (L3)
- Produce a well-organized essay with adequate support and detail (L4)
- Edit short texts by correcting common errors (L3)

Prescribed Textbook:

1. Language and Life, Orient Black Swan (with CD).

Reference Books

1. English Grammar in Use: A Self Study Reference and Practice Book, Raymond Murphy, Fourth Edition, Cambridge Publications
2. English Grammar and Composition, David Grene, Mc Millan India Ltd
3. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
4. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
5. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
6. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
7. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
8. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English	L3
2. read, scan and skim texts such as literary forms, journalistic articles and scientific readings for comprehension and retention	L2
3. exhibit self-confidence and speak in formal and informal contexts	L3
4. apply grammatical knowledge in speech and writing and formulate sentences with accuracy	L2
5. produce coherent and unified paragraphs with adequate support and detail	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
20AC25T.1	-	-	-	-	-	-	-	-	-	3	-	2
20AC25T.2	-	-	-	-	-	-	-	-	-	3	-	2
20AC25T.3	-	-	-	-	-	-	-	-	-	3	-	2
20AC25T.4	-	-	-	-	-	-	-	-	-	3	-	2
20AC25T.5	-	-	-	-	-	-	-	-	-	3	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Electrical Circuits
Category ESC
Course Code 20A221T

Year I
Semester II
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- To learn a number of powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis and graph theory
- To learn the concepts of reactance and impedance to analyze simple a.c. circuits and methods to calculate power and power factor
- To comprehend three phase systems with balanced and unbalanced loads and power measurements
- To solvecomplex circuits using Network theorems.
- To understand frequency response in electrical circuits and clear understanding of the important parameters of coupled circuits.

Unit 1 Network Analysis: 9
Mesh, Super Mesh, Nodal and Super Node analysis-Basic Definitions of Network Topology– Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks –Problems, Network equilibrium equations using topology. Duality & Dual Networks-Problems.
Learning Outcomes: At the end of the unit, the student will be able to:
- Develop the basic concepts of network analysis, which is the pre-requisite for all the electrical engineering subjects.(L4)
- Apply network techniques like node analysis and loop analysis to solve large linear circuits(L3)
- Analyze circuits using graph theory.(L4)

Unit 2 Fundamentals of 1-φ ac circuits: 9
Advantages of AC supply, Types of AC waveforms, Importance of Sine Wave, Basic definitions: Cycle. Time period, frequency, Peak value, peak –peak value. Determination of Average, R.M.S Values, Peak and Form Factor for different Periodic Waveforms, Phase and Phase Difference, j-notation, Steady State Analysis of R, L and C with Sinusoidal Excitation, Concept of Reactance, Impedance, Susceptance and Admittance, Real and Reactive Power, Complex Power, Concept of Power Factor. Analysis of Single Phase ac Circuits-Problems
Learning Outcomes: At the end of the unit, the student will be able to
- Understand and use the concepts of reactance and impedance to analyze simple a.c. circuits(L2)
- Calculate the power dissipation of an a.c. circuit, and understand the concept of power factor.(L3)

Unit 3 Three phase circuits: 9
Advantages of Three phase AC supply-Phase Sequence - Star and Delta Connections-Relation between line, phase voltages and currents in balanced Systems - Analysis of balanced three Phase Circuits - Measurement of active and reactive power in balanced and unbalanced three phase systems - Analysis of three phase unbalanced circuits - Two wattmeter method of measurement of three phase power.
Learning Outcomes: At the end of the unit, the student will be able to:
- Understand 3-phase ac circuits.(L2)
- Solve both balanced and unbalanced 3-phase ac circuits.(L3)
- Measure Power in 3-phase ac circuits.(L3)

Unit 4 Network Theorems 9

Superposition, Thevenin's, Norton's, Maximum Power Transfer,Millman's, Reciprocity, Substitution, Compensation and Tellegen's Theorems for DC and AC excitations

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand network theorems(L2)
- Apply network theorems to solve DC circuits.(L3)

Unit 5 Resonance &magnetically coupled circuits: 9

Resonance – Definition, Resonant frequency, bandwidth and Q-factor for series and parallel resonant circuits, Problems.

Magnetically Coupled Circuits: Coupled circuits – self & mutual inductance, Dot convention, Coefficient of coupling-Analysis of Coupled Circuits

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the effect of resonance(L 2)
- Calculate various parameters and variables under resonance.(L3)
- Understand basic concepts(L1)
- Solve Coupled Circuits(L3)

Prescribed Text Books:

1. Sudhakar & Shyam Mohan s Palli. Circuits and Networks 5th Edition, Tata McGraw Edition (India) Private Limited, 2015.
2. A. Chakrabarti. Circuit Theory. 6th edition, DhanpatRai& Co, New Delhi, 2014.

Reference Books:

1. M.E. Van Valkenberg. Network Analysis. 3rd edition, Pearson Publications, New Delhi 2006.
2. William H. Hayt& Jack E. Kennedy & Steven M. Durbin. Engineering Circuit Analysis. 8th edition, TATA McGraw Hill Company, 2013.
3. J.A.Edminister&M.D.Nahvy. Theory and Problems of Electric Circuits. 4th Edition Schaums Outline series, New Delhi TATA McGraw Hill Company, 2004.
4. G. K. Mittal, Ravi Mittal. Network Analysis. 14th Edition, Khanna Publishers, New Delhi, 1997.
5. C. K. Alexander and M. N. O. Sadiku. Fundamentals of Electric Circuits. 5th Edition, Tata McGraw hill Publishing Company Limited, New Delhi, 2012.

Course Outcomes: Blooms Level of Learning

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

1. Apply the concepts of mesh and nodal analysis and analyze electrical circuits using graph theory. L3
2. Understand the basic concepts of 1-phase and 3-phase ac circuits L2
3. Solve 1-phase and 3-phase ac circuits L2
4. Analyze the circuit using Networktheorems. L4
5. Analyze resonantcircuits. L4
6. Analyze Coupled circuits L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A221T.1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
20A221T.2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
20A221T.3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
20A221T.4	3	2	2	1	1	-	-	-	-	-	-	-	3	-
20A221T.5	3	2	2	1	-	-	-	-	-	-	-	-	3	-
20A221T.6	3	2	2	1	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	**Fundamentals of Electronic Devices and Circuits**
Category	ES
Course Code	20A222T
Year	I
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- Understand the operation of Diode and its applications.
- Understand the BJT operation and its biasing concepts.
- Analyze the small signal model of BJT.
- Understand the operation of FET and its biasing.
- Know the special purpose electronic devices in various applications.

Unit 1 Diodes and Applications 9

PN-junction diode, characteristics, applications - half wave, full wave and bridge rectifier, clippers, clampers, Zener diode, characteristics, applications - voltage regulator.

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand operating characteristics of PN junction diode and Zener diode(L2)
- Know the applications of PN junction diode and Zener diode(L1)

Unit 2 Transistor and Biasing 9

BJT construction and operation, configurations – DC load line analysis – operating point- Bias Stability Need for Stabilization – Stabilization Factors (s, s^1, s^{11}) – Types of Biasing-Fixed Bias, Collector to Base bias, Emitter-Stabilized bias, Voltage Divider Bias.

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the concepts of stability and biasing of BJT.(L2)
- Find the stability factor of different biasing techniques of BJT(L3)

Unit 3 Single Stage Amplifiers 9

Single Stage Transistor Amplifier- Transistor Amplifying Action – Practical circuit of Transistor Amplifier- Classification of Amplifiers- Amplifier equivalent circuit – Concept of h-parameters – Analysis of CE, CB and CC Amplifiers – Comparisons of CE,CB and CC.

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand single stage transistor amplifier and it's operation.(L2)
- Understand the concepts of h-parameters(L2)

Unit 4 Field Effect Transistors & Its Biasing 9

Construction of JFETs – Characteristics – FET Biasing: Fixed Bias Configuration–Self Bias Configuration–Voltage Divider Biasing–Construction and Characteristics of MOSFETs–Depletion type MOSFETs–Enhancement type MOSFET

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the characteristics of JFET and MOSFET(L2)
- Understand the biasing circuits of JFET and MOSFET(L2)

Unit 5 Special Purpose Electronic Devices 8

LED, Tunnel Diode, PIN Diode, SCR, UJT, Photo diode, Photo transistor, Varactor diode, Introduction to Wide band gap devices: SiC & GaN and their applications.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the construction and operation of different special purpose devices L2
- Identify different symbols of special purpose electronic devices. L1

Prescribed Text Books:

1. Electronic Devices and Circuits, David A Bell, Fifth Edition, 2008, Oxford University Press.
2. Electronic Devices and Circuits, J. Millman and Halkias, 1991 edition, 2008, TMH.

Reference Books:

1. Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, 9th edition,PHI.
2. Principles of Electronics, V. K. Mehta, S. Chand Publications2004
3. Integrated Electronics, Analog and Digital Circuits and Systems, J. Millman and Halkias,TMH.
4. Micro Electronic Circuits, Sedra and Smith, Oxford University Press

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the operation of Diode and its applications.	L2
2. Understand the BJT operation and its biasing concepts.	L2
3. Analyze the Small signal model of BJT.	L4
4. Understand the operation of FET and its biasing.	L2
5. Know the special purpose electronic devices in various applications.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A222T 1	-	3	2	-	-	-	-	1	-	-	1	-	3	-
20A222T 2	-	3	3	-	1	-	-	2	-	-	1	-	3	-
20A222T 3	-	3	2	-	1	-	-	1	-	-	2	-	2	3
20A222T 4	-	3	2	-	1	-	-	1	-	-	2	-	2	-
20A222T 5	-	3	2	-	1	-	-	1	-	-	1	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Chemistry Lab
Category	BSC
Course Code	20AC23L
Year	I
Semester	II
Branch	Common to EEE& ECE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:
- To familiarize the students with the basic concepts of chemistry
- To train the students on how to handle the instruments.
- To familiarize the students with digital and instrumental methods of analysis.
- To expose the students in practical aspects of the theoretical concepts.

List of experiments
1. Determination of Zinc by Copmplexometry.
2. Estimation of active chlorine content in Bleaching powder
3. Determination of copper by Iodometry
4. Estimation of ferrous iron by Dichrometry
5. Preparation of Phenol-Formaldehyde resin
6. Determination of Fe (II) in Mohr's salt by potentiometric method
7. Determination of chromium (VI) in potassium dichromate
8. Estimation of mixture of acids by conductometric titration
9. Determination of strength of an acid by pH metric method
10. Determination of viscosity of a liquid by Redwood Viscometer-1
11. Determination of functional groups in the given organic compound
12. Separation of components of a sample by Thin layer chromatography

Prescribed Textbooks:
1. J. Mendham, R.C Denney, J.D Barnes, M. Thomas, B. Sivasankar Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers, 2009.
2. N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company 2009.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Operate instruments such as pH meter, conductivity meter, viscometer and potentiometer.	L3
2. Estimate Zn, Cr, Fe, Cu and other functional groups in various samples	L2
3. Determine physical properties of liquids and synthesize polymers and nano-materials	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
20AC23L.1	3	2	-	-	-	-	-	-	-	-	-	2	3	-	-
20AC23L.2	3	2	-	-	-	-	-	-	-	-	-	2	3	-	-
20AC23L.3	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Fundamentals of Electronic Devices and Circuits Lab
Lab Category	ESC
Course Code	20A222L
Year	I
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	3	1.5

Course Objectives:

- To identify the various electrical and electronic components and devices.
- To analyze the performance of rectifier circuits in practical approach
- To observe the characteristics of semiconductor devices.
- To determine parameters like gain, impedances and band width of BJT and FET amplifiercircuits.

List of the Experiments

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCBs, Diodes,BJTs,ActiveDevices,LowpowerJFETs,MOSFETs,Photodiode,Phototransistor, LEDs, SCR andUJT.
2. Study and operation of
    - Multi-meters (Analog andDigital)
    - FunctionGenerator
    - Regulated PowerSupplies
    - CRO
3. Verification of Kirchhoff's Voltage and CurrentLaw.
4. Forward and Reverse Bias Characteristics of PN junction Diode and Zener Diode.
5. Half Wave Rectifier with and withoutfilter.
6. Full Wave (Center trapped) Rectifier with and withoutfilter.
7. Input and Output Characteristics of Transistor in CE Configuration.
8. JFET Characteristics.
9. MOSFET Characteristics
10. Frequency response of CEAmplifier.
11. SCR Characteristics.
12. LED Characteristics.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Gain the practical knowledge of Diode, BJT, JFET, MOSFET and some special electronic devices.	L1
2. Design the amplifier circuits under given requirements.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A222L.1	2	2	2	2	2	-	2	-	2	-	-	2	2	2
20A222L.2	2	2	2	2	2	-	2	-	2	-	-	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Communicative English Lab
Category HSMC
Course Code 20AC25L

Year I
Semester II
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
0	0	3	1.5

Course Objectives:

- To learn better English pronunciation
- To use language effectively in everyday conversations
- To make formal oral presentations using effective strategies in professional life
- To be exposed to a variety of self-instructional, learner friendly modes of language learning

Detailed Syllabus:

Pronunciation: 6

Introduction to English speech sounds

Learning Outcome:

At the end of the module, the learners will be able to:

- Understand different accents spoken by native speakers of English and speak in intelligible way(L2)

Listening Comprehension: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.Answering a series of questions about main idea and supporting ideas after listening to audio texts.Listening for global comprehension and summarizing what is listened to.

Learning Outcome:

At the end of the module, the learners will be able to:

- Adopt better strategies to listen attentively and comprehend attentively(L2)

Speaking 24

Situational Dialogues (Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions - Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.)

Oral Presentations: Formal oral presentations on topics from academic contexts - Formal presentations using PPT slides with graphic elements,deliver an enthusiastic and well-practiced presentation

Describing people and situations (learn new adjectives, practice describing themselves and others, describe objects using proper adjectives, use details in pictures to make predictions orally, describing situations, Integrate and evaluate information presented in diverse media visually and orally

Learning Outcomes:

At the end of the module, the learners will be able to:

- Speak confidently in formal and informal contexts(L2)
- Comprehend and produce short talks on general topics(L2)
- Use specific vocabulary to describe different persons, places and objects(L3)

Reading 6

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

Learning Outcome: At the end of the unit, the student will be able to:

- Analyze data given in an infographic and write/speak about it(L4)

Minimum Requirements:

1. Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
2. Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a T. V. an LCD projector, a digital stereo –audio & video system and camcorder etc.

Prescribed Textbook: Lab Manual developed by Faculty Members of AITS Rajampet

Suggested Software:

1. Loose Your Accent in 28 days, CD Rom, Judy Ravin
2. Sky Pronunciation Suite
3. Clarity Pronunciation Power – Part I
4. Learning to Speak English - 4 CDs

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Neutralize their pronunciation of English sounds, and their accent	L3
2. Adopt effective listening skills for better comprehension of English, spoken by native speakers	L2
3. Illustrate themselves in social and professional context effectively	L3
4. Improve their public speaking skills and make technical presentations confidently	L4
5. Describe people and situations using adjectives effectively	L3
6. Assess and Deduct data from graphs/pie charts/tables	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC25L.1	-	-	-	-	-	-	-	-	-	2	-	1	-	-
20AC25L.2	-	-	-	-	-	-	-	-	-	1	-	2	-	-
20AC25L.3	-	-	-	-	-	-	-	-	3	3	-	3	-	-
20AC25L.4	-	-	-	-	-	-	-	-	3	2	-	1	-	-
20AC25L.5	-	-	-	-	-	-	-	-	1	3	-	3	-	-
20AC25L.6	-	-	-	-	-	-	-	-	-	2	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Environmental Science
Category	MC
Course Code	20AC26T
Year	I
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	0

Course Objectives:

- To make the student to be aware of environment and understand the importance of protecting natural resources.
- To enable the student to understand the importance of ecosystems and biodiversity for future generations.
- To sensitize the student with pollution problems due to the day-to-day activities of human life.
- To enable the student acquire skills for identifying and solving the social issues related to environment.
- To enable the student to understand the impact of human population on the environment.

Unit 1 Multidisciplinary Nature of Environmental Studies 10

Definition, Scope and Importance – Need for Public Awareness. Natural resources: Renewable and non-renewable resources – Forest resources: Uses, deforestation– Water resources: Uses, floods, And drought – Mineral resources: Uses, environmental effects of extracting mineral resources – Food resources: Impacts of overgrazing, problems with traditional agriculture, effects of modern agriculture – Land Resources: Land degradation, soil erosion - Energy resources: Renewable and non-renewable energy resources.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the importance of public awareness (L1).
- Identify various natural resources (L2).

Unit 2 Ecosystems, Biodiversity and its Conservation 10

Ecosystems: Producers, consumers and decomposers – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, lake ecosystem.

Biodiversity and Its Conservation: Definition – Value of biodiversity - Hot-spots of biodiversity – Threats to biodiversity – Conservation of biodiversity.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the concept of ecosystem (L2).
- Recognize the importance of biodiversity (L2).

Unit 3 Environmental Pollution 8

Definition, Causes, effects and control measures of: Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.

Learning Outcomes: At the end of the unit, the student will be able to:

- Illustrate the different types of pollution (L2).
- Describe various sources, effects and control measures of pollution (L2).

Unit 4 Social Issues and the Environment 10

Rain water harvesting, Environmental ethics: Issues and possible solutions – global warming, acid rain, ozone layer depletion – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act.

Learning Outcomes: At the end of the unit, the student will be able to:

- Interpret social issues related to environment (L3).

- Relate importance of environmental acts (L4).

Unit 5 Human Population and the Environment 7

Population explosion – Family Welfare Programmes – Environment and human health – Value Education – HIV/AIDS – Role of information Technology in Environment and human health, Field work – Visit to a local area to document environmental assets.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understandthe effects of population explosion(L1).
- Identify the natural assets and their relationship(L2).

Prescribed Textbooks:

1. Perspectives in environmental Studies, AnubhaKaushik and C P Kaushik, New Age International Publishers, New Delhi, 2018.
2. A Textbook of Environmental Studies, Shashi Chawla, McGraw Hill Education, New Delhi, 2017.

Reference Books:

1. Environmental Studies by Benny Joseph, McGraw Hill Education, New Delhi, 2017.
2. A textbook of environmental studies, A Dhinakaran and B Sankaran, Himalaya Publishing House, Mumbai, 2017.
3. Fundamentals of environmental studies, MahuaBasu and S Xavier, Cambridge University Press, New Delhi, 2017.
4. Textbook of Environmental Studies for undergraduate courses, ErachBharucha for University Grant Commission, University press, New Delhi, 2013.
5. A textbook of environmental studies, Vijay kumarTiwari, Himalaya Publishing House, Mumbai, 2017.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Explain how natural resources should be used.	L2
2. Identify the needto protectecosystems and biodiversity for future generations.	L3
3. List out the causes, effects, and control measures of environmental pollution.	L1
4. Demonstrate knowledge to the society in the proper utilization of goods and services.	L2
5. Outline the interconnectedness of human dependence on the earth's ecosystems.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC26T.1	1	1	-	-	-	3	3	1	-	-	-	3	-	-
20AC26T.2	1	2	-	-	-	3	3	1	-	-	-	3	-	-
20AC26T.3	-	1	-	-	-	3	3	1	-	-	-	3	-	-
20AC26T.4	2	-	-	-	-	3	3	1	-	-	-	3	-	-
20AC26T.5	1	-	-	-	-	3	3	1	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Transform Techniques & Complex Variables
Category	BSC
Couse Code	20AC32T
Year	II
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To introduce Laplace transforms
- To elucidate the Laplace transforms and their inverses.
- To introduce Fourier series and Fourier Transform to solve real life problems.
- To describe continuity/differentiability/analyticity of a function and find the derivative of a function
- To classify and explain complex power series, singularities, calculus of residues and its applications in the evaluation of integrals.

Unit 1 Laplace transforms 10

Laplace transforms of standard functions- First shifting theorem - change of scale property - multiplication by t^n - division by t - transforms of derivatives and integrals - Laplace transform of periodic functions (without proofs).

Learning Outcomes: At the end of the unit, the student will be able to:
- Examine the properties Laplace transform (L3)
- Apply the Laplace transform for elementary functions (L3)

Unit 2 Inverse Laplace transforms 08

Inverse Laplace transforms (without proofs) – Convolution theorem (without proof).
Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

Learning Outcomes: At the end of the unit, the student will be able to:
- Apply inverse Laplace transform for elementary functions (L3)
- Solve Ordinary differential equations by using Laplace transformation techniques (L3)

Unit 3 Fourier series and Fourier Transforms 11

Fourier series: Dirichlet conditions - functions of any period - odd and even functions - half range series.
Fourier Transforms: Fourier integrals - Fourier cosine and sine integrals - Fourier transform - sine and cosine transform – properties.

Learning Outcomes: At the end of the unit, the student will be able to:
- Determine the Fourier Series expansion for different periodic functions(L3)
- Describe the nature of Fourier series that represent even and odd functions how deviation of a Fourier series can be simplified (l2)
- Examine the properties of Fourier transform (l3)
- Apply the Fourier transform for different functions(L3)

Unit 4 Functions of Complex Variables 10

Continuity - Differentiability - Analyticity - C-R equations (without proof) - harmonic functions - finding harmonic conjugate.
Contour integrals: Cauchy's theorem (without proof) - Cauchy's integral formula - Generalized Cauchy's integral formula (without proof).

Learning Outcomes: At the end of the unit, the student will be able to:
- Define continuity and differentiability of complex functions(L2)
- Apply Cauchy-Riemann equations to complex functions in order to determine whether a given function is

analytic (L3)

- Make use of Cauchy integral theorem to evaluate certain integrals(L6)

Unit 5 Complex Power series and Residues 09

Complex power series: Taylor's series - zeros of analytic functions – singularities - Laurent's series. Residues: Evaluation of residues - Cauchy residue theorem (without proof).

Learning Outcomes: At the end of the unit, the student will be able to:

- Determine the Taylor and Laurent's expansion of simple functions (L3)
- Determine the nature of singularities and calculating residues(l3)
- Make use of Cauchy residue theorem to evaluate certain integral (L6)

Prescribed Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2015.

Reference Books:

1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
4. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe the Properties of the Laplace transformations.	L2
2. Apply Inverse Laplace transformations to solve the ordinary differential equations in engineering.	L3
3. Explain fundamentals of Fourier series and Fourier transforms and apply them to solve Engineering problems.	L2
4. Describe and apply the notation of analytic functions.	L2
5. Apply power series and residue theorem in evaluating the real line integrals.	L3

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
20AC32T.1	3	3	-	-	-	-	-	-	-	-	-	3
20AC32T.2	2	2	-	-	-	-	-	-	-	-	-	2
20AC32T.3	3	3	-	-	-	-	-	-	-	-	-	3
20AC32T.4	3	3	-	-	-	-	-	-	-	-	-	3
20AC32T.5	2	2	-	-	-	-	-	-	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Electrical Machines - I
Category	PCC
Couse Code	20A231T
Year	II
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To describe the performance of various DC machines.
- To discuss the speed control and testing of different DC motors.
- To discuss the performance of single and three phase transformers

Unit 1 DC Machine - Construction and Armature Reaction 09

DC Machines Constructional details, Principle of Operation as a generator and motor, Armature windings (Lap and Wave windings), EMF equation. Armature reaction and its effects – Cross magnetizing and Demagnetizing AT/pole, Methods of improving commutation, Numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to
- Demonstrate the differences between lap and wave windings(L3)
- Demonstrate armature reaction and its effect for various power factors(L3)

Unit 2 DC Generators and Their Characteristics **10**

Types of DC Generators, Magnetization characteristics – critical field resistance and critical speed, Buildup of EMF and causes for failure, Load characteristics of separately excited and self-excited generators, numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to
- Compute critical field resistance and critical speed of the given DC machine(L3)
- Demonstrate the practical reasons for failure of building up of EMF(L3)
- Draw the load characteristics of various DC machines(L3)

Unit 3 DC Motors, Speed control and Testing **10**

Back emf, Torque equation, Characteristics of dc motors (including applications), Starters, Losses and efficiency. Speed control: Armature control, Flux control, Numerical problems.

Testing of DC Machines: Direct testing, Indirect testing (Swinburne‘s test, Hopkinson’s‘test, Field‘s test), Separation of losses, Numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to
- Draw the performance characteristics of various DC motors(L3)
- Compute the performance of various DC motors by testing(L3)

Unit 4 Single Phase Transformer and Testing **10**

Construction, Operation on no-load and load, Phasor diagrams, Equivalent circuit, Regulation of transformer, Losses and efficiency, Effect of variations of frequency & supply voltage on Iron losses. Testing of transformers - Open circuit and short circuit tests, Sumpner ‘s test, Separation of losses test, Numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to
- Demonstrate the basics of Transformer(L3)
- Compute the performance of the given transformer by testing(L3)

Unit 5 Parallel Operation of Transformers, Auto transformer and 3-phase Transformer 08

Parallel operation of single phase transformers, Autotransformers, Comparison with 2 winding transformers, Numerical problems. Three phase Transformers: Connections, Tertiary windings, Scott connection, Numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to

- Demonstrate the need of connecting the transformers in parallel.(L3)
- Demonstrate the differences between ordinary transformer and auto transformer.(L3)
- Draw the 3-Ph transformer connections.(L3)

Prescribed Text Books:

1. Ashfaq Hussain - Electrical Machines, 3rd Edition, Dhanpat Rai Publishers, 2016.
2. B L Theraja, A K Theraja – A Text book of Electrical Technology, Vol. II, 23/e, S. Chand Publications, 2014.
3. P.S. Bimbhra - Electrical machinery, 7th Edition, Khanna Publishers, 2011.

Reference Books:

1. A.E. Fitzgerald, C. Kingsley and S. Umans - Electric Machinery, 6th Edition, Tata McGraw-Hill, 2010
2. Mukherjee and Chakravarthy - Electrical Machines, 2nd Edition, Dhanpat Rai Publishers, 2010.
3. I.J. Nagrath& D.P. Kothari, ―Electric Machines,5th Edition, Tata McGrawhill Publishers,2017.

Web Resources:

1. https://www.youtube.com/watch?v=LPcQYXjPdIQ&list=PLp6ek2hDcoNCANsWM2mw3qi0387BhfLyV
2. http://www.nptelvideos.in/2012/11/electrical-machines-i.html
3. https://nptel.ac.in/courses/108/102/108102146/
4. https://freevideolectures.com/course/3085/electrical-machines-i
5. https://www.youtube.com/playlist?list=PL9RcWoqXmzaJpnkjoNleyFNgGk9-znOji

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Demonstrate the basics of various DC machines.	L1
2. Analyze the performance characteristics of various DC Generators.	L4
3. Compute the losses and efficiency of DC generators and motors.	L3
4. Determine the regulation and efficiency of transformer by testing.	L3
5. Summarize various three phase transformer connections.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A231T.1	3	1	1	1	1	-	-	-	-	-	-	3	3	-
20A231T.2	3	1	1	2	1	-	-	-	-	-	-	3	3	-
20A231T.3	3	2	2	2	1	-	-	-	-	-	-	3	3	-
20A231T.4	3	2	1	2	2	-	-	-	-	-	-	3	2	2
20A231T.5	3	2	1	1	1	-	-	-	-	-	-	3	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Network Analysis and Signals
Category	PCC
Couse Code	20A232T
Year	II
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To analyze two port network parameters,
- To analyze transient response of R, L, C circuits
- To apply Laplace transforms to electrical circuits
- To analyze the continuous and discontinuous signals
- To apply Fourier Series and Fourier transforms to electrical circuits

Unit 1 Two port networks 10

Two Port Network Parameters – Impedance, Admittance, Transmission and Hybrid Parameters and Their Relations, Condition for Reciprocity and Symmetry-inter connections.

Learning Outcomes: At the end of the unit, the student will be able to
- Analyze two port network parameter conditions for reciprocity and symmetry (L4)
- Identify the network parameters for different networks configurations like T and π networks.(L1)
- Illustrate the relationship and interconnection of different two port parameters(L3)

Unit 2 Laplace transforms 10

Definition of Laplace transform – advantages - Laplace transform of important functions and common signals – inverse Laplace transform - application of Laplace transform to electrical circuits – initial and final value theorem

Learning Outcomes: At the end of the unit, the student will be able to
- Analyze Laplace transform of important functions and signals (L4)
- Analyze inverse Laplace transform(L4)
- Analyze electrical circuits response using Laplace transform(L4)

Unit 3 Transient Analysis (AC & DC) 10

Introduction- Initial Conditions -DC Transient response of RL, RC and RLC series circuits -Response of RL, RC and RLC series circuits with AC excitation

Learning Outcomes: At the end of the unit, the student will be able to
- Analyze transient response of electrical circuits with DC excitation using classical method and Laplace transform approach (L4)
- Analyze transient response of electrical circuits with AC excitation using classical method and Laplace transform approach (L4)

Unit 4 Signals 10

Basic definitions, Classification of continuous time Signals and Classification of discrete time, operations on signals, Concepts of Convolution and Correlation of signals.

Learning Outcomes: At the end of the unit, the student will be able to
- List out various types of signals.(L1)
- Analyze the various mathematical operations on different types of signals. (L4)

Unit 5 Fourier Series & Fourier Transforms 10

Introduction- trigonometric Fourier series - waveform symmetry, exponential form of Fourier series, effective value,

application to electrical networks. Fourier transforms &Properties, Fourier transform of important signals and Fourier transform of a periodic signals.

Learning Outcomes: At the end of the unit, the student will be able to

- Analyze different wave form symmetry(L4)
- Illustrate how to converter non sinusoidal periodic and aperiodic wave form to sinusoidal waveform using Fourier series and Fourier transform(L3)
- Explain properties of Fourier transforms(L2)

Prescribed Text Books:

1. D. Roy Choudhury. Networks and Systems. 2rd edition, New Age international publishers 2013.
2. Circuits theory (analysis and synthesis) 7th Revised edition by Abhijit chakrabarti. 2018
3. A Nagoor kani. Signals and systems 4th edition , Tata Mcgraw Hill publishing company Ltd., 2010

Reference Books:

1. A. Sudhakar, Shyammohan S Palli. Circuits and Networks. (Anal,ysis and Synthesis), 5th edition, Tata McGrawHill Publishing company Ltd, 2017
2. M.E. Van Valkenburg. Network analysis. 3rd edition,C.A.Publications, 2010
3. William H Hayt Jr. Jack E. Kemmerly, Steven M. Durbin. Engineering Circuit Analysis. 8th edition, Tata Mcgraw Hill publishing company Ltd., 2013
4. Umesh Sinha. Network Analysis and Synthesis. 5th edition, Satyaprakashan, New Delhi.2018
5. IJ Nagrath, S.N. Saran, R. Ranjan and S. Kumar, “Signals and Systems”, TataMc.Graw Hill, 2001.

Web Resources:

1. https://nptel.ac.in/courses/108/105/108105159/
2. https://nptel.ac.in/courses/108/106/108106163/
3. https://nptel.ac.in/courses/108/102/108102042/

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the calculation of two port Network parameters.	L3
2. Analyze the Laplace transforms and inverse Laplace transforms of electrical circuits.	L3
3. Analyze the transient response of electrical circuits for DC and AC excitations.	L3
4. Describe different types of signals.	L1
5. Analyze the Fourier series and Fourier transforms of electrical circuits	L3

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A232T.1	3	3	3	2	1	-	-	-	-	-	-	-	3	-
20A232T.2	3	3	-	-	2	-	-	-	-	-	-	-	2	-
20A232T.3	3	2	2	-	-	1	-	-	-	-	-	-	3	1
20A232T.4	2	3	3	-	-	-	-	-	-	-	-	-	3	-
20A232T.5	3	3	1	-	-	-	-	-	-	-	-	-	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Analog Electronics
Category	PCC
Couse Code	20A233T
Year	II
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To discuss the concept of Feedback Amplifier and oscillators.
- To discuss signal analysis using Op-amp based circuits
- To provide basic knowledge on special ICs like Timers, PLL circuits and its applications.
- To analyze A/D and D/A Converter.

Unit 1 Feedback Amplifiers and Oscillators: 9

Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien Bridge, Hartley, Colpitts and Crystal oscillators.

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the concept, type of feedback amplifiers and oscillators.(L2)
- Describe feedback amplifiers and oscillators. .(L2)

Unit 2 Operational Amplifier and its Linear Applications: 9

Ideal OP-AMP characteristics, Internal Block diagram of op-amp, DC characteristics, AC characteristics, Basic op-amp applications, Instrumentation Amplifier, AC amplifier V/I & I/V converters, Differentiator, Integrator, Log and Antilog Amplifiers.

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the concept of Op-Amp characteristics and its linear applications. .(L2)
- Analyze Op-amp based circuits. (L4)

Unit 3 Non Linear Applications of op-amp: 9

Comparator and its applications, Multivibrators: Astable and Monostable operation, Schmitt Trigger, Triangle and Sawtooth Waveform Generator, Op-amp circuits using Diodes: Half-wave Rectifier, Full-wave Rectifier, Peak-value detector, Clipper, Clamper, Sample and Hold circuits, RC Active Filters.

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the concept of Op-Amp and its Non-linear applications. .(L2)
- Analyze Op-Amp based circuits (L4)

Unit 4 555 Timer and PLL: 9

IC 555 Timer and applications: Monostable operation, Applications in Monostable mode, Astable operation, Applications in Astable mode, Phase Locked Loop- Phase Detector, VCO, Monolithic PLL, Applications of PLL.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the concept of 555 Timers and its applications. .(L2)
- Discuss the concept of Functional blocks and the applications of PLL. (L2).

Unit 5 D/A and A/D Converters: 9

Introduction to DAC/ADC, Basic DAC Techniques: Weighted Resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Monolithic DAC, A/D Converters: Flash AC, Counter Type ADC, Servo Tracking ADC, Successive Approximation ADC, Dual Slope ADC, DAC/ADC specifications

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the concept of A/D and D/A Converter.(L2)
- Design A/D and D/A Converter.(L6)

Prescribed Text Books:

1. David A. Bell," Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Sedra and smith, "Microelectronic circuits", 7th Ed., Oxford University Press.
3. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.

Reference Books:

1. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 PHI
2. S.Salivaganan, L.S.Kanchana, "Linear Integrated Circuits', III edition, Mc. Graw Hill, 2018

Web Resources:

1. https://nptel.ac.in/courses/108/108/108108114/
2. https://www.youtube.com/watch?v=SrvkXEIWuK4
3. https://www.youtube.com/watch?v=6PhVUTRx3JA
4. https://www.youtube.com/watch?v=bJNDh46uI3w

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe and gain knowledge on Feedback Amplifier and oscillators.	L1, L4
2. Describe the importance of Signal analysis using Op-amp based circuits	L1, L3
3. Describe and acquire knowledge on the Non-linear Applications of Op-amp.	L1, L3
4. Functional blocks and the applications of special ICs like Timers, PLL circuits.	L1, L3
5. Design and analysis of A/D and D/A Converter	L1, L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A233T.1	3	2	2	-	1	-	-	-	-	-	-	1	2	1
20A233T.2	3	2	2	1	1	-	-	-	-	-	-	1	2	1
20A233T.3	3	2	2	1	1	-	-	-	-	-	-	1	2	1
20A233T.4	2	3	3	1	1	-	-	-	-	-	-	1	2	2
20A233T.5	2	3	3	1	1	-	-	-	-	-	-	1	2	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Switching Theory and Logic Design
Category	ESC
Couse Code	20A234T
Year	II
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To analyze the concepts and techniques associated with the number systems and codes
- To minimize the logical expressions using Boolean postulates
- To design various combinational and sequential circuits.

Unit 1 Number Systems, Codes & Boolean Algebra 10

Introduction to number systems – r, (r-1)'s complement 1's & 2's complement, 9's & 10's Complement, representation of negative numbers, Binary arithmetic, Binary codes, Error detecting &Error correcting codes, hamming code.
Boolean Algebra: Fundamental postulates of Boolean algebra, Basic theorems and Properties, Logic gates, Properties of XOR gate, universal gates.
Learning Outcomes: At the end of the unit, the student will be able to
- Summarize the advantages of using different number systems (L2)
- Explain the usefulness of different coding schemes(L2)

Unit 2 Switching Functions and Their Minimization 10

Switching Functions-Canonical and Standard forms, Algebraic simplification using Boolean theorems, two level & Multilevel Realization of Boolean Functions using Universal Gates.
Minimization: K-Map methods, Prime implicants, don't care combinations, Minimal SOP and POS forms,
Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the functionality of logic gates (L2)
- Apply basic laws & De Morgan's theorems to simplify Boolean expressions (L3)
- Compare K- Map & Q-M methods of minimizing logic functions(L3)

Unit 3 Combinational Logic Design & Programmable Logic Devices: 09

Design using conventional logic gates-Binary Adders, Subtractors, Ripple Adder, Magnitude comparator, Encoder, Decoder, Multiplexer, De-Multiplexer (1-Line to 4-Line and 1-Line to 8-Line).
PLD's: ROM, PROM, PLA, PAL, and Realization of Switching functions using PLD's. Comparison between PLA, PAL, ROM.
Learning Outcomes: At the end of the unit, the student will be able to
- Analyze standard combinational circuits such as adders, subtractors etc.(L4)
- Design simple combinational logic circuits.(L6)
- Implement logic functions with decoders and multiplexers. .(L6)
- Describe and compare functional differences between different type PLDs. (L2)

Unit 4 Sequential Circuits 10

Classification of sequential circuits (Synchronous, Asynchronous, Pulse mode, Level mode), Basic flip-flops, Triggering and excitation tables, flip flop conversions, Design of modulo-N Synchronous counters – up/down counter, ring counter, Johnson counter.
Learning Outcomes: At the end of the unit, the student will be able to
- Design sequential circuits using Latches and flip flops.(L6)

- Construct digital systems using counters.(L4)
- Design synchronous sequential circuits using flip flops.(L6)

Unit 5 FSM Minimization and ASM Charts 08

Finite state machine-capabilities and limitations, Mealy and Moore models and their conversions, minimization of completely specified sequential machines, Partition technique.Algorithmic State Machines: Salient features of the ASM chart.

Learning Outcomes: At the end of the unit, the student will be able to:

- Compare Moore and Mealy machine models.(L4)
- Minimization of completely specified sequential machines(L3)
- Know Salient features of the ASM chart(L1)

Prescribed Text Books:

1. A. Anand Kumar, Switching Theory and Logic Design.3rd Edition, PHI Learning Pvt. Ltd., 2016.
2. M.Morris Mano, Digital Design. Pearson,5th Ed, 2013.

Reference Books:

1. Zvi Kohavi, Switching& Finite Automata Theory. TMH, 2nd Edition, 2008.
2. Charles H. Roth, Jr, Larry L.Kinney. Fundamentals of Logic Design. Cengage Learning, 2015, 6th Ed.
3. William I. Fletcher, An Engineering Approach to Digital Design. Pearson, 3rd Ed, 2015.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs67/preview.
2. https://www.udemy.com/course/switching-theory-logic-design-of-digital-circuits.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the number systems and codes.	L4
2. Simplify the logics expressions using Boolean laws and postulates.	L1
3. Minimize the logic expressions using map method and tabular method.	L3
4. Design combinational logic circuits using conventional logic gates and various programmable logic devices.	L5
5. Design sequential logic circuits and Finite state machines.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A234T.1	3	3	3	-	3	3	-	-	-	-	-	3	3	3
20A234T.2	3	3	3	-	3	-	-	-	-	-	-	3	3	3
20A234T.3	3	3	3	-	3	3	-	-	-	-	-	3	3	3
20A234T.4	3	3	3	3	3	3	-	-	-	-	-	3	3	3
20A234T.5	3	3	3	3	-	-	-	-	-	-	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Electrical Machines – I Lab
Category PCC
Couse Code 20A231L

Year II
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
- To sketch the performance characteristics of various DC machines
- To describe the speed control methods of different DC motors
- To evaluate the total losses in DC machine

List of Experiments
Perform any ten experiments out of the following
1. Magnetization characteristic of separately excited DC Generator.
2. Performance characteristics of DC Shunt Generator by load test.
3. Performance characteristics of DC Series Generator by load test.
4. Load test on Load test on DC Compound Generator by load test.
5. Back-to-Back test on two similar DC Shunt Machines.
6. Pre-determination of DC Shunt machine by Swinburne's test.
7. Speed control of DC shunt motor.
8. Performance characteristics of DC Compound motor by Brake test.
9. Performance characteristics of DC Shunt motor by Brake test.
10. Performance characteristics of DC Series motor by Brake test.
11. Separation of losses in DC shunt machine.
12. Field's test on two similar DC series machines
13. Performance characteristics of DC compound Generator by load test.

Web Resources:
1. http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html
3. http://vem-iitg.vlabs.ac.in/
4. https://www.youtube.com/watch?v=LPcQYXjPdIQ&list=PLp6ek2hDcoNCANsWM2mw3qi0387BhfLyV

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Identify various parts of DC machine and different types of Starters.	L1
2. Draw the Internal and external characteristics of various DC Generators.	L2
3. Draw the performance characteristics of various DC Motors.	L3
4. Function effectively as individual and as member in a team.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A231L.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20A231L.2	2	3	3	2	1	-	-	-	-	-	-	-	2	2
20A231L.3	1	2	2	2	1	-	-	-	-	-	-	-	2	1
20A231L.4	-	-	-	-	-	-	-	-	2	2	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Circuits Lab
Category	PCC
Couse Code	20A232L
Year	II
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	3	1.5

Course Objectives:

- To demonstrate various network solving techniques and theorems of electrical circuits
- To calculate self and mutual inductance and coefficient of coupling of coupled circuits
- To calculate network parameters of the two-port networks
- To describe the phenomenon of series and parallel resonance
- To measure active and reactive power of 3-Φ balanced loads

List of Experiments

Perform any ten experiments out of the following

1. Verification of Mesh & Nodal analysis
2. Verification of Thevenin's and Norton's theorems
3. Maximum Power Transfer theorems for DC and AC circuits
4. Verification of Superposition theorem
5. Verification of compensation theorem
6. Verification of Reciprocity and Millman's theorems
7. Determination of self and mutual inductances and co-efficient of coupling.
8. Calibration of Z and Y Parameters
9. Calibration of Transmission and hybrid parameters
10. Series and Parallel resonance
11. Measurement of Active power for Star and Delta connected balanced loads
12. Measurement of Reactive power for Star and Delta connected balanced loads

Web Resources:

1. https://www.youtube.com/watch?v=IBjdVAK4QxM
2. https://www.youtube.com/watch?v=jOcAgNdJyps
3. https://youtube.com/TAT0PmKVB4Q
4. https://youtube.com /r487fbbLoMY
5. https://youtube.com /NlSkjl3QR8c

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Apply various theorems to electrical and verify practically	L4
2. Estimate the self, mutual inductances and co-efficient of coupling of single phase transformer.	L2
3. Analyze the two port network parameters.	L4
4. Analyze the Phenomenon of Resonance.	L4
5. Estimate the active and reactive power of different types of loads.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A232L.1	3	-	3	2	-	-	-	-	-	-	-	-	3	-
20A232L.2	1	-	1	2	-	-	-	-	-	-	-	-	1	-
20A232L.3	3	-	3	3	-	-	-	-	-	-	-	-	3	-
20A232L.4	2	-	3	2	-	-	-	-	-	-	-	-	2	-
20A232L.5	3	-	3	3	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Electrical and Electronics Simulation Lab
Category ESC
Couse Code 20A233L

Year II
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	3	1.5

Course Objectives:
- To demonstrate theorems of electrical circuits
- To evaluate DC machine's performance
- To describe operation of Logic gates
- To sketch diode, transistor and JFET characteristics
- To analyze the operation of passive filters
- To analyze continuous time signals

List of Experiments
Perform any ten experiments out of the following
1. Simulation of Thevenin's& Maximum Power Transfer Theorem.
2. Simulation of Compensation Theorem and Superposition Theorem.
3. Simulation of DC circuits:
   a). DC Transfer function
   b). DC Sweep Analysis
4. Magnetization characteristics of DC Shunt generator using Simulation.
5. Load Test on DC Series Motor using Simulation.
6. Load characteristics of DC Shunt Generator Using Simulation.
7. Simulation of Two port Network parameters.
8. Study of Series Resonance using Simulation.
9. Study of Logic gates AND, OR, NOT and Universal gates.
10. Determination of average value, RMS value, form factor and peak factor of sinusoidal and square waveforms using Simulation.
11. Measurement of ripple factor of Half Wave Rectifier and Full Wave Rectifier.
12. Simulation of Lowpass and High pass passive filter.
13. Generation and operation of continuous time signals.
14. Simulation of PN Junction and Zener Diode characteristics.
15. Simulation of input and output characteristics of transistor in CE configuration.
16. Simulation of Drain and Transfer characteristics of JFET.

Web Resources:
1. https://www.youtube.com/watch?v=RxY9tYHOM1I&t=16s
2. https://www.youtube.com/watch?v=XDjouFhEPlE&list=PLcE2DGluSqU4nggIpuH7RE8f_4u7bKM3O&index=3
3. https://www.youtube.com/watch?v=CxDlEpWrlyA&list=PLcE2DGluSqU4nggIpuH7RE8f_4u7bKM3O&index=5
4. https://www.youtube.com/watch?v=RxY9tYHOM1I&list=PLcE2DGluSqU4nggIpuH7RE8f_4u7bKM3O&index=6

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Apply various theorems and verify practically using simulation software	L4
2. Study of DC machines performance practically using simulation software	L4
3. Experimentally analyze the two port network parameters using simulation software	L4

4. Analyze the Phenomenon of Resonance using simulation software L4
5. Analyze the Diode, Transistor and JFET characteristics using simulation software L3
6. Study of various logic gates using simulation software L4
7. Analyze the passive filters and continuous time signals using simulation software L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A233L.1	3	3	3	-	3	-	-	-	-	-	3	-	3	-
20A233L.2	3	3	3	-	3	-	-	-	-	-	3	-	3	-
20A233L.3	3	3	3	-	3	-	-	-	-	-	3	-	3	-
20A233L.4	3	3	3	-	3	-	-	-	-	-	3	-	3	-
20A233L.5	3	3	3	-	3	-	-	-	-	-	3	-	3	-
20A233L.6	3	3	3	-	3	-	-	-	-	-	3	-	3	
20A233L.7	3	3	3	-	3	-	-	-	-	-	3	-	3	

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	PCB Design with EAGLE
Category	SC
Couse Code	20A235L
Year	II
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
1	-	2	2

Course Objectives:

- To explain various numerical methods to solve algebraic and transcendental equation and interpolation
- To introduce various numerical methods for evaluating definite integrals and numerical solution of ordinary differential equations
- To describe the measures of central tendency.
- To introduce the basic concepts of probability theory.
- To elucidate probability distribution for solving problems in engineering.

Unit 1 Introduction to PCB T:3, P:6

What is PCB - Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer)- PCB Materials. Draw a Schematic, Bill of materials (B.O.M.), Types of Components -Active Components- Diode- Transistor- MOSFET- LED- SCR- Integrated Circuits (ICs)- Passive Components- Resistor-Capacitor-Inductor-Transformer Speaker/Buzzer Component Package Types.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn types of Printed Circuit Boards(L1)
- Select the required components (L1)

Unit 2 Introduction: Setting Up EAGLE T:3, P:6

Introduction to PCB Design using Eagle tool, Installing Eagle software, Initial Startup, Components and Library Creation (Symbol,Package, Device), Creating a New Schematic Design (Starting a Project, Placing Parts, Finishing Up)

Learning Outcomes: At the end of the unit, the student will be able to:

- Demonstrate PCB design software (L3)
- Explain creation of schematic (L2)

Unit 3 PCB Laying Out the Board T:3, P:6

PCB Layout Designing- Prototype Designing, Board Editor, Arrange the Components, Creating Traces, Ground Plane. Error Checking, Initialize and Outline Board, Connections and Routing (The Auto Router, Manual Routing, Setting Up a Simple Auto Route, Optimizations, Manual Traces & Shapes), Generating Gerber's, Self-Check and Final Touches, Post-lab Reviewing the Files. Selecting a Manufacturer.

Case Study: Design one circuit for hardware development.

Learning Outcomes: At the end of the unit, the student will be able to:

- Design a circuit in software (L6)
- Describe the concept of PCB design for manufacturer.(L2)

Unit 4 PCB Fabrication Process-I T:3, P:6

Finalizing PCB and Studying the Circuit for errors, printing final circuit using laser printer on glossy paper, selecting proper size of Copper clad PCB, transform the circuit onto copper clad PCB with proper temperature.

Learning Outcomes: At the end of the unit, the student will be able to:

- Demonstrate the development of copper clad PCB (L3)
- Describe the concepts of transform the circuit onto copper clad PCB. .(L2)

Unit 4 PCB Fabrication Process-II T:3, P:6

Etching process (any Etching process), Safety precautions before starting the Etching process, Cleaning the PCB. Drilling holes on PCB. Components Mounting, Soldering and De-soldering.

Case Study: DIY PCB Prototyping

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the copper clad PCB Etching process(L2)
- Describe the concepts of drilling, components mounting and soldering.(L2)

Prescribed Text Books:

1. Simon Monk, Duncan Amos - Make Your Own PCBs with EAGLE_ From Schematic Designs to Finished Boards.
2. Scarpino Matthew, Designing Circuit Boards with EAGLE: Make High-Quality PCBs at Low-Cost Kindle Edition.
3. Application Note: PCB Design with EAGLE

Reference Books:

1. Tom Clarke, © Imperial College London The EAGLE Schematic & PCB Layout Editor - A Guide
2. Autodesk Eagle manual version 9.5 Copyright © 2019 Autodesk
3. R. S. Khandpur - Printed Circuit Boards_ Design, Fabrication, Assembly and Testing (2005, MC GRAW HILL INDIA).

Web Resources:

1. https://www.udemy.com/topic/circuit-design/
2. https://onlinecourses.swayam2.ac.in/aic20_sp59/preview

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Summarize the steps involved in schematic, layout, fabrication and assembly process of PCB design.	L2
2. Design a circuit and create a schematic Capture	L5
3. Design (schematic and layout) and fabricate PCB for simple circuits.	L5
4. Summarize the concept of developing copper clad PCB	L2
5. Summarize the concept of copper clad PCB Etching process and soldering	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A235L.1	3	3	3	-	3	3	-	-	-	-	-	3	3	3
20A235L.2	3	3	3	-	3	-	-	-	-	-	-	3	3	3
20A235L.3	3	3	3	3	3	3	-	-	-	-	-	3	3	3
20A235L.4	3	3	3	3	3	3	-	-	-	-	-	3	3	3
20A235L.5	3	3	3	3	3	3	-	-	-	-	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course MATLAB PROGRAMMING
Category SC
Couse Code 20A236L

Year II
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practical	Credits
1	0	2	2

Course Objectives:

- To know the basic operations of MATLAB
- To enable the students to know the file operations.
- To acquire the knowledge on two dimensional and three dimensional plots.
- To understand fuzzy logic tool box
- To understand neural network tool box

Following topics are covered in MATLAB Programming

1. Basic operations on matrices.
2. Conditional statements
3. For-end Loops and While-end Loops
4. Two dimensional and three dimensional plots
5. File operations
6. Solving Nonlinear equations
7. Solving ordinary differential equations
8. Finding minimum and maximum of a functions
9. Numerical Integration function
10. Fuzzy logic tool Box
11. Neural network tool box

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Analyze the basic operations of matrices	L4
2. Analyze programming tools in MATLAB	L4
3. Solve different mathematical functions	L3
4. Apply fuzzy logic tool box	L3
5. Apply neural network tool box	L3

Web Resources:

1. https://www.mathworks.com/
2. https://en.wikipedia.org/wiki/MATLAB
3. https://in.mathworks.com/products/simulink-online.html
4. https://in.mathworks.com/help/matlab/

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A236L1	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A236L2	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A236L3	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A236L4	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A236L5	3	3	3	3	3	-	-	-	3	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Numerical Methods and Random Variables
Category	BSC
Couse Code	20AC42T
Year	II
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To explain various numerical methods to solve algebraic and transcendental equation and interpolation
- To introduce various numerical methods for evaluating definite integrals and numerical solution of ordinary differential equations
- To describe the measures of central tendency.
- To introduce the basic concepts of probability theory.
- To elucidate probability distribution for solving problems in engineering.

Unit 1 Solutions of algebraic and transcendental equations and Interpolation 10

Bisection method – Regula Falsi method and Newton-Raphson method.
Finite differences - forward differences and backward differences - Newton's forward interpolation formula and Newton's backward interpolation formula - Lagrange's interpolation formula.
Learning Outcomes: At the end of the unit, the student will be able to:

- Find approximate roots of an equation by using different numerical methods (L1)
- Apply Newton's forward and backward formulae for equal interval (L3)

Unit 2 Numerical Solutions of ordinary differential equations of first order 10

Numerical Differentiation, Numerical integration- Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.
Numerical Solutions of ordinary differential equations of first order: Taylor's series, Euler's method, Modified Euler's method - Runge-Kutta method of fourth order.
Learning Outcomes: At the end of the unit, the student will be able to:

- Find integration of a function by using different numerical methods(L1)
- Solve ordinary differential equations by using different numerical schemes(L3)

Unit 3 Introduction to statistics 10

Mean, Median and Mode for ungrouped and grouped data.Correlation - correlation coefficient – Karl Pearson's coefficient - Spearman's rank correlation,
Learning Outcomes: At the end of the unit, the student will be able to:

- Summarize the basic concepts of data science and its importance in engineering(L2)
- Analyze the data quantitatively or categorically measure of averages variability(L4)
- Adopt Correlation methods and principle of least squares, regression analysis(L3)

Unit 4 Probability 10

Axioms of probability - addition theorem of probability - conditional probability- multiplication theorem of probability - Baye's theorem. Random variables - discrete and continuous - Distribution functions - Mean and variance.
Learning Outcomes: At the end of the unit, the student will be able to:

- Define the terms trail, events, sample space, probability and laws of probability(L1)
- Make use of probabilities of events in finite sample space from experiments(L6)
- Apply Baye's theorem to real time problems(L3)
- Explain the notation of random variable, distribution functions and expected value(L2)

Unit 5 Probability distributions 08

Probability distributions – Binomial and Poisson distribution - fitting - normal distribution - their properties.

Learning Outcomes: At the end of the unit, the student will be able to:

- Apply binomial, passion distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the probabilities of normal distribution and its applications (L3)

Prescribed Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

Reference Books:

1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India, 2009.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Apply the knowledge of numerical methods to solve algebraic and transcendental equations and acquire the knowledge of interpolation	L3
2. Apply the techniques of numerical differentiation, Integration and numerical solutions of ordinary differential equations to engineering Problems.	L3
3. Calculate and interpret the correlation between two variables.	L3
4. Analyze the basic concepts of probability and random variables	L4
5. Use probability distribution for random variables in Engineering field.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
20AC42T.1	3	3	-	-	-	-	-	-	-	-	-	3
20AC42T.2	3	3	-	-	-	-	-	-	-	-	-	3
20AC42T.3	3	3	-	-	-	-	-	-	-	-	-	3
20AC42T.4	3	3	-	-	-	-	-	-	-	-	-	3
20AC42T.5	2	2	-	-	-	-	-	-	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Electrical Machines - II
Category	PCC
Couse Code	20A241T
Year	II
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To describe the performance of various three phase and fractional power Induction motors.
- To discuss the speed control of different three phase Induction motors.
- To discuss the performance of three phase synchronous machines.

Unit 1 Three phase Induction Motor 10

Construction, working principle, slip, torque equation, expressions for maximum torque and starting torque, torque - slip characteristics, rotor input, rotor copper losses, mechanical power developed and relations, power flow diagram, crawling and cogging, double-cage and deep-bar rotors, circle diagram & predetermination of performance, numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to:
- Demonstrate the construction of various rotors(L3)
- Demonstrate how the compute the performance of the given induction motor by drawing circle diagram. (L3)

Unit 2 Starting and Speed control of Induction Motor 09

Starting of three phase induction motor: Starting methods: direct online starting, stator reactor starting, autotransformer starting, star-delta starting and starting current and starting torque calculations, numerical problems.

Speed control of Induction motors: Speed control – change of frequency, change of poles– cascade connections, rotor resistance method, injection of an emf into rotor circuit (qualitative treatment only), induction generator (qualitative treatment only), and numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to:
- Demonstrate the practical reason for use of starters. (L3)
- Identify the suitable method for speed control of given Induction motor.(L1)

Unit 3 Fractional Horse Power Motors 08

Construction, working principle, starting methods and types - split-phase induction motors, capacitor motors, capacitor start motors, two value capacitor motors, permanent split capacitor (PSC) motor, equivalent circuit of single phase induction motor, shaded pole induction motor, universal motor.

Learning Outcomes: At the end of the unit, the student will be able to:
- Demonstrate why the 1-Ph induction motor is not a self-starting. (L3)
- Demonstrate the feature of universal motor(L3)

Unit 4 Synchronous Generator - Regulation 11

Construction, armature windings – full pitch and short pitch, concentrated and distributed windings, winding factor, EMF equation, Armature reaction, numerical problems.

Regulation of Alternators: Regulation of Alternators: Regulation of alternator by synchronous impedance method, M.M.F. method and Z.P.F method, two reaction analysis, experimental determination of Xd and Xq, phasor diagrams, regulation of salient pole alternators, numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the various armature windings of alternator.(L2)
- Compute the regulation of given alternator by various methods.(L3)
- Demonstrate the basics of projecting pole type alternator. (L3)

Unit 5 Parallel operation of Alternators & Synchronous motors 09

Parallel operation of Alternators: Synchronization of alternators with infinite bus bars, synchronization methods, synchronizing current and power, parallel operation and load sharing, numerical problems.

Synchronous motors: Theory of operation, starting methods, effect of change in excitation, V and inverted V curves, hunting and its suppression, synchronous condenser, numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the practical feature of Synchronous motor(L2)
- Know the importance of connecting the alternators in parallel.(L1)

Prescribed Text Books:

1. Ashfaq Hussain - Electrical Machines, 3rd Edition, Dhanpat Rai Publishers. 2016
2. B L Theraja, A K Theraja – A Text book of Electrical Technology, Vol. II, S. Chand Publications. 2014
3. P.S. Bimbhra - Electrical machinery, 7th Edition, Khanna Publishers. 2011

Reference Books:

1. A.E. Fitzgerald, C. Kingsley and S. Umans - Electric Machinery, 6th Edition, Tata McGraw-Hill, 2010.
2. Mukherjee and Chakravarthy - Electrical Machines, 2nd Edition, Dhanpat Rai Publishers, 2010.
3. I.J. Nagrath& D.P. Kothari, ―Electric Machines,5th Edition, Tata McGrawhill Publishers,2017.

Web Resources:

https://www.youtube.com/watch?v=exfUnnxnGEw&list=PLbRMhDVUMngcDrGXIt-hX-ekpldUIC2b6

Course Outcomes: Blooms Level of Learning

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

1. Demonstrate the basics of various AC machines. L1
2. Analyze the performance characteristics of three phase induction motor by speed control. L4
3. Demonstrate the working of various fractional horse power motors. L2
4. Compute the regulation of different synchronous generators. L3
5. Draw the performance curves of synchronous motor at various field excitations. L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A241T.1	3	3	2	1	1	-	-	-	-	-	-	3	3	1
20A241T.2	3	3	1	2	2	-	-	-	-	-	-	2	3	1
20A241T.3	3	1	1	1	1	-	-	-	-	-	-	2	3	-
20A241T.4	3	2	1	1	1	-	-	-	-	-	-	3	3	1
20A241T.5	2	2	1	2	1	-	-	-	-	-	-	2	3	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Electrical and Electronics Measurements
Category	PCC
Couse Code	20A242T
Year	II
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To Describe basic principles of all measuring instruments.
- To describe the measurement of RLC parameters using various bridges.
- To analyze the measurement of voltage, current, power, energy and power factor by using different meters.
- To analyze the digital meters and smart meters.

Unit 1 Measuring Instruments 10

Methods of measurements, Classification of instruments, Characteristics of instruments, Error-definition and types, Error Analysis with simple numerical problems – Forces required to operate an instrument, different mechanisms used to obtain deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance.

Learning Outcomes: At the end of the unit, the student will be able to:
- describe the concept of basic requirements in measuring instruments(L2)
- describe the construction and working of different basic measuring devices(L2)

Unit 2 Measurement of Power, Energy & Power Factor 10

Power measurement: Single-phase dynamometer wattmeter – LPF wattmeter – Double element and three element dynamometer wattmeter. Energy measurement: Single-phase induction type energy meter – Driving and braking torques – Errors and compensations, Single-phase Dynamometer Power factor meters.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the Construction and Working of Wattmeter, Energy Meter and Power Factor Meter(L2)
- Solve the Numerical Problems on Measurement of Power, Energy and Power Factor(L3)

Unit 3 Potentiometers & Measurement of Frequency 10

Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: Polar and Coordinate type's standardization – applications.
Principle and operation of single-phase frequency meter- vibrating reed type, - ferro dynamic type meters.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the Construction and Working of DC & AC Potentiometers(L2)
- Describe the Construction and Working of different types of Frequency Meters(L2)

Unit 4 DC & AC Bridges 10

Method of measuring low, medium and high resistance – sensitivity of Wheat stone's bridge – Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method. Measurement of inductance–Maxwell's bridge, Anderson's bridge. Measurement of capacitance–Desauty's bridge, Schering Bridge. Measurement of frequency–Wien's bridge.

Learning Outcomes: At the end of the unit, the student will be able to:
- Evaluate the unknown parameters using DC & AC Bridges(L5)
- Solve the Numerical Problems in Measurement of Resistance, Inductance, Capacitance and Frequency(L3)

Unit 5 Smart & Digital Meter 10

Basic Block Diagram of Digital Voltmeter, Advantages and Disadvantages, Resolution and Simple Numerical Problems, Types of DVM's - Successive approximation, dual slope, ramp and integrating type DVM's, Digital frequency meter-Digital multimeter-Digital Tachometer.

Construction and working of smart energy meter-Advantages and Disadvantages

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the Concept of Working of Different types of DVM's(L2)
- Describe the Construction and Working of Smart Energy Meter(L2)

Prescribed Text Books:

1. E.W. Golding and F.C. Widdis Electrical Measurements and measuring Instruments, 5th Edition, Reem Publications.
2. A.K.Sawhney, Electrical & Electronic Measurement & Instruments, Dhanpat Rai & Co. Publications.

Reference Books:

1. R K Rajput Electrical & Electronic Measurement & Instrumentation., 2nd Edition, S. Chand & Co.
2. H. S. Kalsi Electronic Instrumentation. Tata Graw Hill Mc, 3rd Edition.
3. Reissland, M.U Electrical Measurements: Fundamentals, Concepts, Applications-New Age International (P) Limited, Publishers.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ee44/preview
2. https://www.classcentral.com/course/swayam-electrical-measurement-and-electronic-instruments-14032
3. https://www.electrical4u.com/
4. https://circuitglobe.com/
5. https://www.electricaldeck.com/

Course Outcomes: Blooms Level of Learning

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

1. Describe basic requirements and the concepts of electrical measuring instruments. L3
2. Measure the energy and power through energy meter and wattmeter L2
3. Explain the concept of potentiometers and working of the frequency meters L3
4. Measure the resistance, inductance, capacitance and frequency L2
5. Explain the principle and operation of Smart and Digital meters L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A242T.1	3	2	-	-	-	-	-	-	-	-	-	-	3	3
20A242T.2	3	2	-	-	-	-	-	-	-	-	-	-	3	3
20A242T.3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
20A242T.4	3	3	2	-	-	-	-	-	-	-	-	-	-	3
20A242T.5	3	3	-	-	3	-	-	-	-	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Electromagnetic Fields
Category	PCC
Couse Code	20A243T
Year	II
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To describe basic laws related to electromagnetic fields such as Coulomb's Law, Biot-Savart's law, Gauss's Law and Amperes Law.
- To describe the significance of Maxwell's Equations in Electromagnetic Phenomenon
- To discuss the concepts of Inductance and Capacitance.
- To get familiarized with Time Varying Fields and Displacement current.

Unit 1 Electrostatics-I 10

Types of Co-ordinate Systems, Differential Line, Surface and Volume Elements in various co- ordinate systems-Electrostatic fields- Various Charge Distributions -Coulomb's law - Electric Field Intensity (EFI) - EFI due to a Continuous charge distributions- Finite Line, Infinite line and Infinite surface charge distributions- Electric Flux density-Gauss's Law - Applications of Gauss law to symmetrical charge distributions(Point, Infinite line and Infinite surface Distributions) –Application of Gauss's Law to differential volume element - Maxwell's first equation

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe various co-ordinate systems(L2)
- Determine the electric field due to various charge distributions using Coulomb's Law and Gauss's Law(L3)
- Derive Maxwell's I equation and describe its significance.(L3)

Unit 2 Electrostatics-II 10

Energy expended in moving a point charge in an electric field-Potential-Potential Difference –Maxwell's second equation- Potential Gradient -energy density in electrostatic fields

Electric Dipole-Dipole moment - Potential and EFI due to an electrical Dipole-Torque on an Electric Dipole in an electric field-Current density - Conduction and Convection current density - Polarization - Boundary Conditions-Capacitance-Capacitance of parallel plate, Spherical and Co-axial capacitors with composite dielectric -Laplace's and Poisson's equations- Application of Laplace's Equation in one dimension

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the concepts like Work, Potential and Potential Gradient in Electric fields. (L2)
- Describe the phenomenon of Polarization in Dielectric Materials.(L2)
- Determine the Capacitance of different capacitors.(L3)
- Describe the use of Laplace's equation and Poisson's equations in finding the field.(L2)
- Derive Maxwell's II equation and describe its significance.(L3)
- Describe the concepts like Work, Potential and Potential Gradient in Electric fields. (L2)

Unit 3 Magnetostatics-I 10

Biot-Savart's law- Magnetic Field Intensity(MFI) due to current distributions- MFI due to a straight current carrying filament(Finite and Infinite), Circular and Solenoid current carrying wire- Ampere's Circuital law -Maxwell's third equation- Applications of Ampere's law to Infinite line current, Infinite Sheet of current, Infinitely long co-axial transmission line, Long Solenoid-Toroid-Magnetic Flux Density-Relation between B and H Maxwell's fourth equation- Scalar magnetic potential and its limitations-Vector magnetic potential- Vector Magnetic Potential for current distributions(only formulae)-Biot Savart's Law from vector magnetic Potential.

Learning Outcomes: At the end of the unit, the student will be able to:

- Determine Magnetic Field due to various current carrying conductors using Biot-Savart's Law, Ampere's Law. (L3)
- Derive Maxwell's III equations and describe their significance.(L3)
- Describe the importance of Vector and Scalar Magnetic Potential. (L2)

Unit 4 Magnetostatics-II 10

Magnetic Forces- Force on moving charges - Lorentz force equation- Force on a current element -Force on a straight and long current carrying conductor in magnetic field - Force between two straight long and parallel current carrying conductors - Magnetic Dipole and Dipole moment - Torque on a current loop placed in a magnetic field -Magnetization – B-H curve - Self-Inductance of a solenoid, Toroid, Co-axial cable, Magnetic Boundary Condition- Energy density in magnetic field.

Learning Outcomes: At the end of the unit, the student will be able to:

- Apply Lorentz force equation to determine the force on a conductor in magnetic field and force between two conductors.
- Describe the concept of torque on a current loop in magnetic field. (L2)
- Describe the phenomenon of Magnetization in magnetic materials. (L2)
- Determine the inductance of Solenoid, Toroid and Co-axial cable. (L2)

Unit 5 Electrodynamics Fields 08

Time Varying fields – Faraday's Experiment- Faraday's laws of electromagnetic induction -statically and dynamically induced EMF – simple problems. Modifications of Maxwell's equations for time varying fields(Point forms and Integral forms) - Displacement current , Displacement Current Density- Poynting theorem and Poynting vector

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the methods of inducing the EMF using Faraday's Laws. (L2)
- Describe the significance of displacement current and displacement current density their significance in time varying fields. (L2)
- Describe the pointing theorem and pointing vector. (L2)

Prescribed Text Books:

1. 'Engineering Electromagnetics' by W.H. HAYT & J.A.BUCK ,7/e, McGaw Hill Education India Publications
2. 'Principles of Electromagnetics' by Matthew N.O.Sadiku,S.V.Kulkarni, 6/e, Oxford University Press Publications

Reference Books:

1. Electromagnetic Field Theory and Transmission Lines by G.S.N.Raju, 1/e, Pearson Publisher
2. Field Theory, A. Gangadhar& P.M. Ramanathan,5/e, Khanna publishers, New Delhi, 2008
3. Theory and problems of Electromagnetics, Joseph A .Edminister , 4/e ,Schaum's Outline series Mc.Graw Hill companies ,New Delhi,2009.

Web Resources:

1. https://www.classcentral.com/course/youtube-electrical-electro-magnetic-magnetic-fields-47689/classroom
2. https://onlinecourses.nptel.ac.in/noc21_ee83/preview

Course Outcomes:	Blooms Level of Learning
At the end of the course, the student will be able to	
1. Apply the basic laws of magneto statics and corresponding Maxwell equations to find out magnetic field due to various current distributions	L3
2. Analyze the Polarization and Magnetization characteristics of various materials.	L2
3. Apply the concepts of electromagnetism to determine Capacitance and Inductance	L3
4. Recognize the significance of Faradays laws and time varying fields in Electrical Engineering.	L2
5. Apply the basic laws of electrostatics and corresponding Maxwell equations to find out electric field due to various charge distributions	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A243T.1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20A243T.2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20A243T.3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
20A243T.4	2	3	-	-	-	-	-	-	-	-	-	-	3	-
20A243T.5	2	3	-	-	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Managerial Economics and Financial Analysis
Category	HSMC
Course Code	20AC45T
Year	II
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To describe the concepts and tools of economic analysis.
- To apply concepts in real life by developing problem solving skills there exists a relationship between Managerial Economics and Financial Accounting.
- To focus on picking up the basics of accounting such as Accounting Data and Financial Statements, which constitute the language of Business.
- The student is made familiar with journalizing, interpretation and use of Accounting Data

Unit 1 Introduction to Managerial Economics and Demand Analysis 12

Managerial Economics: Meaning and Nature, Definition, Scope, relationship with other areas. Demand Analysis: Definition and types of Demand, Demand Determinants, and Law of Demand and its exceptions, Elasticity of Demand-types, measurement and Significance, Demand forecasting methods.

Learning Outcomes: At the end of the unit, the student will be able to:

- Remember the scope and relationship with other areas of Managerial Economics. (L1)
- Explain types of demand and demand forecasting methods. (L2)

Unit 2 Production and Cost Analysis 10

Production: Production Function, Cobb-Douglas Production function, Iso-quants and Iso-costs, MRTS, Least Cost Combination of Inputs, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts, Determinants of cost, cost-output relationship in short run and Long run. Break-Even Analysis (BEA): Objectives, Assumptions, Importance, Graphical representation, Limitations, simple numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Remember production function and economies of Scale. (L1)
- Differentiate cost concepts. (L4)
- Explain BEP concepts in practically. (L1)

Unit 3 Market Structure and Forms of Business Organizations 12

Markets: Perfect market, imperfect market- Monopoly, Monopolistic and Oligopoly Markets. Price-output determination in perfect competition and monopoly in long run and short run. Forms Of Business Organizations: Definition, Forms of Business Organizations-Private Sector-sole proprietorship, Partnership, Joint Hindu family business, co-operative societies, joint stock companies. Public Sector- Departmental organizations, public corporations, government companies.

Learning Outcomes: At the end of the unit, the student will be able to:

- State the functions of different forms of business organizations. (L1)
- Define Perfect market, imperfect market- Monopoly, Monopolistic and Oligopoly Markets(L1)

Unit 4 Capital and Capital Budgeting 10

Capital: Definition of Capital and its significance, Types of Capital, Sources of raising Capital. Capital Budgeting: Definition, Nature and scope of capital budgeting, features of capital budgeting, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method, Profitability Index Method (Simple Problems).

Learning Outcomes: At the end of the unit, the student will be able to:

- Remember types and Sources of raising Capital. (L1)
- Compare and select techniques of Investment Analysis.(L4)

Unit 5 Introduction to Financial Accounting and Analysis 10

Financial Accounting: Accounting definition, Principles of accounting, Book Keeping, Journal, Ledger, Trial Balance, Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis: Definition of Financial Analysis, Ratios and its significance- types- liquidity Ratios, turnover Ratios - solvency Ratios and profitability ratios

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand Financial Accounting Concepts(L1)
- Use Financial Accounting and Analysis in practical life (L3)

Prescribed Text Books:

1. Gupta: Managerial Economics, TMH, 2009
2. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2003
3. Mehta P.L., Managerial Economics-Analysis, Problems, Cases, S Chand and Sons,New Delhi, 2001.
4. M.E. Thukaram Rao., Accounting for Managers, New Age International Publishers.
5. T.S, Reddy and Y. Hari Prasad Reddy, Accounting and Financial Management, Margham Publications.

Reference Books:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Edition.
3. Suma Damodaran, Managerial Economics, Oxford University Press.
4. Lipsey & Chrystel, Economics, Oxford University Press.
5. Domnick Salvatore: Managerial Economics In a Global Economy, 4th Edition, Thomson.

Course Outcomes:	Blooms Level of Learning
At the end of the course, the student will be able to	
1. Predict the demand for a product or product mix of a company and to analyze various factors influencing demand elasticity.	L1
2. Assess the cost behavior, costs useful for managerial decision making and determine Break Even Point (BEP) of an enterprise.	L2
3. Differentiate private and public sector undertakings in their promotion, incorporation, regulation, administration, legal formalities and existence.	L2
4. List features, steps, merits, uses & limitations of Pay Back, ARR, NPV, PI and IRR methods of Capital Budgeting and compute rank of the projects.	L3
5. Analyze, interpret and comment on the financial statements of a business enterprise by using liquidity leverage, coverage and turnover & profitability ratios.	L3 and L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AE41T.1	2	-	-	-	2	-	2	-	-	-	-	-	-	-
20AE41T.2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
20AE41T.3	2	-	1		2	-	-	-	-	-	2	-	-	-
20AE41T.4	-	-	-	-	-	-	-	-	-	-	3	-	-	-
20AE41T.5	2	2	-	-	-	-	2	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Life Sciences for Engineers
Category	MC
Couse Code	20AC44T
Year	II
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To introduce the origin of life.
- To provide the basis for classification of living organisms.
- To describe the transfer of genetic information.
- To introduce the techniques used for modification of living organisms.
- To describe the applications of biomaterials

Unit 1 The Living World 08
Nature and Scope of Biology, Origin and Evolution of Life, Systematics, Classification of living organisms, Viruses, Prokaryotes and Eukaryotes.
Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the concept of origin of life.(L2)
- Classify the different types of organisms.(L1)

Unit 2 Cell and Cell Division 08
Plant cell and Animal cell, Structure of the cell: Nucleus, Ribosome's. Molecules of the cell: Nucleic acids, Cell Cycle: Mitosis, Meiosis.
Learning Outcomes: At the end of the unit, the student will be able to:
- Discusses the structure and function of the cell. .(L2)
- Differentiate the stages of cell division.(L4)

Unit 3 Physiology of Plants and Animals 12
Photosynthesis, Respiration: Types of respirations, Glycolysis, TCA Cycle, Nervous system, Endocrine system in animals.
Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the importance of photosynthesis and respiration process. .(L2)
- Explain the vital role of Co-ordinate system in animals. .(L2)

Unit 4 Genetics 12
Genetic basis of Inheritance, Mendel's laws, Human genetic disorders: Hemophilia, Colour Blindness, Autosomal abnormalities: Down's, Patau's and Edward's syndromes. Genetic Engineering: Recombinant vaccines, Basis of DNA finger Printing, Animal cloning.
Learning Outcomes: At the end of the unit, the student will be able to:
- Define the gene and its importance in heredity.(L1)
- Describe the effects of gene mutations. .(L2)
- Apply the concept of genetic engineering in development of vaccines.(L3)

Unit 5 Biology in Human Welfare 08
Parasitism, Plasmodium vivax, Wuchereria bancrofti, Health and Disease: Bacterial, Viral diseases: HIV, Biomedical technologies: X-Ray, CT- Scan, MRI- Scan, PET-Scan.
Learning Outcomes: At the end of the unit, the student will be able to:

- Identify the causes of pathogenic diseases and effects on human health.(L1)
- Explain the importance of biomedical techniques. .(L2)

Prescribed Text Books:

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

Reference Books:

1. Alberts Et.Al. The molecular biology of the cell, 6/e, Garland Science, 2014
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012
4. PS Verma | VK Agarwal.Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand Publishing, 2004.

Course Outcomes: Blooms Level of Learning

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

1. Explain stages of Systematics. L2
2. Summarize application of biomolecules. L2
3. Identify DNA as a genetic material in the molecular basis of information transfer. L3
4. Analyze biological processes at the Genetic Engineering. L4
5. Identify the potential of recombinant DNA technology. L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC44T.1	2	2	-	-	-	2	-	-	-	-	-	2	-	-
20AC44T.2	2	2	-	-	-	2	-	-	-	-	-	2	-	-
20AC44T.3	3	3	-	-	-	3	-	-	-	-	-	3	-	-
20AC44T.4	3	3	-	-	-	3	-	-	-	-	-	3	-	-
20AC44T.5	2	2	-	-	-	2	-	-	-	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Electrical Machines – II Lab
Category PCC
Couse Code 20A241L

Year II
Semester II
Branch EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
- To sketch the performance characteristics of various AC machines

List of Experiments
Perform any ten experiments out of the following
1. Performance of 1-Φ transformer using O.C. and S.C. tests.
2. Determination of performance of 1-Φ transformer using Sumpner's test.
3. Conversion of 3-Φ supply to 2-Φ supply using Scott connection – Verification.
4. Performance of 3-Φ induction motor using No-load & blocked rotor tests.
5. Calculation Regulation of a 3-Φ alternator by E.M.F and M.M.F. methods.
6. V and inverted V curves of a 3-Φ synchronous motor.
7. Determination of Xd and Xq of a salient pole synchronous machine.
8. Equivalent circuit of a 1-Φ induction motor.
9. Parallel operation of 1-Φ transformers – Load sharing.
10. Separation of stray losses of a 1-Φ transformer.
11. Determination of performance of 3-Φ Induction motor using Brake test.
12. Determination of performance of 1-Φ Induction motor using Brake test.
13. Determination of Efficiency of a 3-Φ alternator.
14. Measurement of sequence impedance of a 3-Φ alternator.

Web Resources:
1. http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html
3. http://vem-iitg.vlabs.ac.in/
4. https://www.youtube.com/watch?v=LPcQYXjPdIQ&list=PLp6ek2hDcoNCANsWM2mw3qi0387BhfLyV

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Identify various parts of Static, Rotating machines and starters	L1
2. Draw the performance characteristics of various AC machines.	L2
3. Draw the equivalent circuits of Static, Rotating machines.	L3
4. Function effectively as individual and as member in a team.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A231L.1	3	-	-	-	-	-	-	-	-	-	-	2	3	-
20A231L.2	2	3	3	2	1	-	-	-	-	-	-	1	2	1
20A231L.3	2	2	2	2	1	-	-	-	-	-	-	1	2	2
20A231L.4	-	-	-	-	-	-	-	-	2	2	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Electrical Measurements Lab
Category	PCC
Couse Code	20A242L
Year	II
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
- To discuss the principle of various measuring instruments
- To determine the value of unknown R, L and C parameters
- To discuss the methods of finding electrical system parameters
- To discuss statistical data analysis and acquisition

List of Experiments
Perform any ten experiments out of the following
1. Calibration and testing of 1-Φ energy Meter.
2. Calibration of dynamometer type power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin ‘s double Bridge, Wheatstone Bridge – Measurement of resistance
5. Measurement of % ratio error and phase angle of given C.T. by Silsbee’s method.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3-Φ reactive power with 1-Φ wattmeter.
8. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods.
9. Calibration of wattmeter – by Phantom testing.
10. Dielectric oil testing using H.T. testing Kit.
11. Measurement of frequency by Wien’s Bridge.
12. Measurement of iron loss in a bar specimen using a CRO and using a wattmeter.
13. Measurement of High resistance and Insulation resistance using Megger.
14. Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.
15. Usage of DSO for steady state periodic waveforms produced by a function generator. Selection of trigger source and trigger level, selection of time-scale and voltage scale. Bandwidth of measurement and sampling rate.

Web Resources:
1. http://vlabs.iitkgp.ernet.in/asnm/
2. https://nitsri.ac.in/Department/DisplayDeptPage.aspx?page=magsk&ItemID=kagem&nDeptID=g
3. https://www.iitr.ac.in/departments/EE/pages/Research+Facilities+Labs+Electrical_Measurement_Laboratory.html
4. http://www.facweb.iitkgp.ac.in/~avishek/Measurements2020.html

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Calculate the absolute error of measuring instruments (Wattmeter, Power factor meter, Energy meter, CT testing)	L4
2. Measure the electrical circuit parameters (R, L, C, choke coil parameters, Megger)	L6
3. Measure the electrical system parameters (3-Φ reactive power and frequency)	L6
4. Measure the dielectric strength of the oil.	L6
5. Perform statistical data analysis and data acquisition.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A242L.1	3	3	3	-	-	-	-	-	3	-	-	-	3	3
20A242L.2	3	3	3	-	2	-	-	-	3	-	-	-	3	3
20A242L.3	3	3	3	2	2	-	-	-	3	-	-	-	3	3
20A242L.4	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A242L.5	3	3	3	-	3	-	-	-	3	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Analog Electronics Lab
Category	PCC
Couse Code	20A244L
Year	II
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
- To describe the analysis of transistor-based amplifiers
- To generate different types of non-sinusoidal signals
- To verify the applications of Op-Amp

List of Experiments
Perform any ten experiments out of the following
1. Two stage RC-Coupled Amplifier
2. Hartley/ Colpitts Oscillator
3. Feedback Amplifier (Current Series & Voltage Series)
4. Linear Wave Shaping
5. Class A power Amplifier
6. Class B power Amplifier
7. Non-Linear Wave Shaping-Clippers
8. Non-Linear Wave Shaping-Clampers
9. Op-Amp application – Adder and Subtractor circuits
10. Op-Amp application- LPF, HPF (First order)
11. Function Generator using Op-Amp
12. IC 555-Timer- Monostable and Astable operation circuit.
13. Bit DAC using Op-Amp

Web Resources:
1. https://www.youtube.com/watch?v=401pZY_V5z
2. https://www.youtube.com/watch?v=JxI1wY5p-mM
3. https://www.youtube.com/watch?v=0hJ2Hpm8oj8
4. https://www.youtube.com/watch?v=Gu_CwktVZTk
5. https://www.youtube.com/watch?v=yK9Br1c6Dhg
6. https://www.youtube.com/watch?v=DYn4OpJFZOw

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Design of Amplifiers with its frequency response	L4
2. Design of oscillators with its frequency response	L4
3. Evaluate the efficiency of power Amplifier	L4
4. Design wave shaping circuits.	L4
5. Identify the applications of Op-Amp and Timer	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A244L.1	3	2	2	2	2	-	-	-	-	-	-	-	2	-
20A244L.2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
20A244L.3	3	1	1	-	2	-	-	-	-	-	-	-	2	-
20A244L.4	3	2	2	2	2	-	-	-	-	-	-	-	2	-
20A244L.5	3	2	2	2	-	-	-	-	-	-	-	-	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Python Programming
Category SC
Couse Code 20A545L

Year II
Semester II
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
1	-	2	2

Course Objectives:
- To learn basics of computational problem solving, python programming and basic control structures.
- To understand python programming basic constructs like lists, dictionaries, sets and functions
- To apply module design and usage of text files in python programming

Module 1 Introduction to python programming language: T:4, P:6
Introduction to python programming language, literals, variables and identifiers, operators, expressions and data types. Control Structures: Boolean expressions, selection control, and iterative control.
Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the importance of python programming (L2)
- remember control structures and use them in the python programs(L1)

Module 2 Lists: T:3, P:6
Lists: List structures, lists in python, iterating over lists in python, more on python lists. Dictionaries and sets, tuple.
Learning Outcomes: At the end of the unit, the student will be able to:
- Construct python programs using list type (L3)
- Demonstrate programs on dictionaries and sets, tuple. (L3)

Module 3 Functions: T:4, P:6
Functions: Program routines, more on functions, Module Design: Modules, Top-Down design, python modules
Learning Outcomes: At the end of the unit, the student will be able to:
- Illustrate the importance of module and use them (L3)
- Infer programs on text files(L3)

Module 4 Text Files: T:3, P:6
Text Files: Text File, Using Text files, string processing, exception handling
Learning Outcomes: At the end of the unit, the student will be able to:
- Describe about text files and use in python programs (L2)
- Analyze string processing and exception handling in programming (L4)

Module 5 Introduction to Object oriented programming: T:4, P:6
Introduction to Object oriented programming: class, three fundamental features of object oriented programming, encapsulation-what is encapsulation, defining classes in python. Inheritance: subtypes, defining subclasses in python, Polymorphism: use of polymorphism.
Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the fundamentals of object oriented programming (L2)
- Reframe programs using class and object in python programming.(L4)

Prescribed Text Books:
1. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, Charles Dierbach.

Reference Books:

1. Python Programming using problem solving approach, ReemaThareja, Oxford University press
2. Python Programming: An Introduction to Computer Science, John Zelle, Franklin,Beedle & Associates Inc.,3rd Edition
3. Think Python: How to think like a computer Scientist, Allen Downey 2nd Edition O'Reilly Publications.

Course Outcomes: Blooms Level of Learning

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

1. Understand computational problem solving and basic elements of python programming. L2
2. Construct python programming basic constructs like lists, tuple, dictionaries, and sets. L3
3. Implement string processing and exception handling in programming L5
4. Analyze string processing and exception handling in programming. L4
5. Reframe programs using class and object in python programming. L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A545L.1	3	-	3	-	-	-	-	-	-	-	-	3	-	-
20A545L.2	3	-	3	3	-	-	-	-	-	-	-	3	-	-
20A545L.3	3	-	3	3	-	-	-	-	-	-	-	3	-	-
20A545L.4	3	-	3	3	-	-	-	-	-	-	-	3	-	-
20A545L.5	3	-	3	3	-	-	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Linear Control Systems
Category	PCC
Couse Code	20A251T
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To provide an introduction to the analysis of linear control systems.
- To exploit time domain and frequency domain tools.

Unit 1 Introduction to Control Systems 10

Concepts of Control Systems- Open Loop and closed loop control systems Examples, Effects of feedback-Mathematical models, differential Equations, Transfer Function, Mechanical Translational & Rotational systems, Electrical analogy, Block Diagram representation of systems - Block diagram algebra, Signal Flow graph and Mason's gain formula. Transfer function of DC servo motor, Tacho generator, Synchro transmitter and receiver.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the basic concepts of control systems(L2)
- Describe the various physical systems(L2)
- Describe the various methods to determine the transfer function(L2)

Unit 2 Time Domain Analysis 8

Standard input signals, Time response of first order system, Time response of second order system, Characteristic equation, time-domain specifications, steady state error, Static error coefficients, Introduction to proportional control, Integral Control, Derivative Control

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the concept of various test signals(L2)
- Describe the response of first and second order systems in time domain(L2)
- Describe the concept of error in control systems(L2)

Unit 3 Stability and Frequency Domain Analysis 9

Concepts of stability, Absolute stability and relative stability, Routh-Hurwitz criterion, Root locus, Relation between time and frequency response, Frequency response specifications, Polar plot, Nyquist stability criterion, Gain margin and Phase margin

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the various terms related to stability (L2)
- Describe the various techniques to determine stability like root locus and R-H criterion(L2)
- Describe the concept of stability and response in frequency domain(L2)

Unit 4 Design of compensators 9

Bode plot and stability determination, Gain margin and Phase margin. Lead compensation, Lag compensation, Lag-lead compensation, Design of compensators using bode plot

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the concept of determining stability using Bode plots(L2)
- Describe the concept of compensators(L2)

Unit 5 State Space Analysis 9

Concept of state, state variable and state model, State space analysis to transfer function, transfer function to

state space, State Transition Matrix and its properties, Solution of linear state equation, Determination of controllability and Observability using Kalman's test

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the basic concepts related to state space(L2)
- Describe the technique to determine state space from transfer function and vice-versa(L2)
- Describe the concepts of controllability and Observability(L2)

Prescribed Text Books:

1. Katsuhiko Ogata "Modern Control Engineering" — Prentice Hall of India Pvt. Ltd.,5th dition,2010
2. I.J.Nagrath and M. Gopal "Control Systems Engineering" New Age International (P) Limited, Publishers, 6th edition, September 2018

Reference Books:

1. Control Systems Engineering - by NISE 8th Edition – John Wiley& sons, Feb 2019.
2. Control Systems –by A. Nagoor Kani– 3rd Edition RBA Publications,2017.
3. Automatic Control Systems– by B. C. Kuo and Farid Golnaraghi John Wiley and sons,9th edition,2009.

Web Resources:

1. http://www.nptelvideos.com/control_systems/
2. https://www.youtube.com/watch?v=Q7r29_Lv-7g
3. https://www.tutorialspoint.com/control_systems/control_systems_bode_plots.htm
4. https://www.tutorialspoint.com/control_system/problem_on_polar_plot.asp

Course Outcomes: Blooms Level of Learning

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

1. Describe the basic components of control systems. L2
2. Describe the concept of time response and PID controllers L2
3. Analyze the stability of linear systems using frequency response. L3
4. Illustrate the design of lead and lag compensators to meet the desired system performance specifications L3
5. Develop and design different state space models L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A251T.1	3	3	3	-	2	1	-	-	-	-	3	3	3	3
20A251T.2	3	3	3	-	3	1	-	-	-	-	3	3	3	3
20A251T.3	3	3	3	-	3	3	1	-	-	-	3	3	3	3
20A251T.4	3	3	3	-	3	3	3	-	-	-	3	3	3	3
20A251T.5	3	3	3	-	3	3	3	-	-	-	3	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power Electronics
Category	PCC
Couse Code	20A252T
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To discuss the basic theory of power semiconductor devices and their practical applications
- To explain the concepts of conversion and control to analyze power electronic converters suitable for AC/DC, DC/DC and DC/AC.

Unit 1 Fundamentals of Power Semiconductor Devices 10

Brief introduction to Thyristor family –Basic operation of Power MOSFET and Power IGBT- Silicon Controlled Rectifiers (SCR's) – Principle of operation of SCR – Static characteristics and Dynamic turn ON switching characteristics of SCR – Two transistor analogy of SCR.-Turn ON methods of SCR - Gate characteristics of SCR- - Turn OFF mechanism and Turn OFF methods-Natural and Forced Commutation methods for SCR-Series and Parallel connections of SCRs- Problems -R, RC and UJT firing circuits.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the characteristics of different types of power semiconductor devices.(L2)
- Compare series and parallel connection of SCR's, and various commutation methods.(L4)

Unit 2 Protection Circuits for Power Electronic Devices 10

Specifications and Ratings of SCR – Voltage, Current and Power ratings – Protection against dv/dt with design of Snubber circuit-di/dt Protection with help of inductor- Over voltage protection by Metal Oxide Varistors – Over current protection by fast acting current limiting fuse– Gate Protection-Improving dv/dt rating with Cathode short-di/dt improvement by high gate current - Cooling mechanism of SCR –Problems.

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the protection circuits of power electronic devices. (L4)
- Explain the cooling mechanism of SCR's.(L2)

Unit 3 AC to DC Converters 10

Operation and analysis of Single phase and three phase uncontrolled and controlled rectifiers with R, RL and back EMF load-Derivation of average and RMS load voltage and current -Active and Reactive power inputs to the converters-Effect of freewheeling diode -Numerical problems- Effect of source inductance on single phase and three phase fully controlled bridge rectifier with RL load–single phase and three phase Dual converters-Power factor improvement methods for phase controlled rectifiers.

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the operation of AC to DC converters. (L4)
- Distinguish the operation of Half & Fully controlled converters. .(L2)
- Apply the concepts of AC to DC converters to solve numerical problems (L3)

Unit 4 DC to DC Converters 9

Principle of buck converter, boost converter and buck boost converter operation–Control strategies-Time ratio control & current limit control– Derivation of average load voltage, RMS voltage and load current for continuous current operation-ripple current-ripple factor- Numerical problems–Operation of Single quadrant chopper -Two quadrant DC chopper, Four quadrant DC chopper)- Problems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Analyze the operation of DC to DC converters.(L4)
- Identify the suitable choppers for motoring and braking applications.(L2)
- Apply the concepts of DC to DC converters to solve numerical problems. (L3)

Unit 5 DC to AC and AC to AC Converters 10

Single phase inverters – Basic series inverter– Basic parallel inverter- Voltage Source Inverter - half bridge and full bridge types - Current Source Inverter- Voltage control techniques of single phase inverters- External Control methods - Internal control methods-Pulse Width Modulation Techniques-single PWM–Multiple PWM and Sinusoidal PWM. Problems. AC voltage controllers – Single phase half wave and full wave type regulators with R and RL loads – Derivation of RMS load voltage, current and power factor –Numerical problems-Three phase Regulator - Cyclo converters – Single phase midpoint and bridge configuration of cyclo converters with resistive and inductive loads - problems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Analyze the operation DC/AC and AC/AC converters(L4)
- Distinguish the applications of regulators and inverters.(L4)
- Apply the concepts of DC to AC converters and AC to AC converters to solve numerical problems. (L3)

Prescribed Text Books:

1. M. D. Singh & K. B. Kanchandhani. Power Electronics, Tata Mc Graw Hill Publishing Company, Revised edition 2013
2. P.S.Bimbhra. Power Electronics, Khanna Publishers, 2014
3. Ned Mohan, Power Electronics, second edition, john wiley & sons Inc 2014

Reference Books:

1. Vedam Subramanyam, Power Electronics, 3rd Edition, New Age International (P) Limited, 2008
2. M.H.Rashid, Power Electronics Circuits Devices and Applications. 3rd edition, Pearson, 2014
3. John G. Kassakian, Martin F. Schlecht and George.C.Verghese. Principles of Power Electronics, Pearson Edition, 2010
4. P.C. Sen, Power Electronics, Tata Mc Graw-Hill Publishing Company, 2014

Web Resources:

1. https://nptel.ac.in/courses/108/102/108102145/
2. https://nptel.ac.in/courses/108/101/108101126/
3. https://nptel.ac.in/courses/108/101/108101038/
4. https://nptel.ac.in/courses/108/107/108107128/

Course Outcomes: Blooms Level of Learning

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

1. Demonstrate fundamental concepts and techniques used in power electronics. L3
2. Analyze the protection circuits of power electronic devices and cooling mechanism. L4
3. Analyze various single phase and three phase power converter circuits. L4
4. Discuss the operating principle and various types of DC-DC converters. L2
5. Analyze the construction and operation of voltage source inverters, voltage controllers and Cyclo converters. L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A252T.1	3	3	3	-	-	-	-	-	-	-	-	-	1	1
20A252T.2	-	3	-	2	2	-	-	-	-	-	-	-	-	-
20A252T.3	3	3	3	-	2	-	-	-	-	-	-	-	1	1
20A252T.4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
20A252T.5	3	-	3	2	-	-	-	-	-	-	-	-	1	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Electric Power Transmission and Switch gear
Category	PCC
Couse Code	20A253T
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To enrich the students with the fair knowledge of transmission line parameters and performance
- To analyze mechanical design of transmission
- To understand operation of switchgear Equipment's.

Unit 1 Transmission Line Parameters 10

Electrical design of Overhead Transmission Lines – Calculation of Line constants of 1- phase, 3-phase system of symmetrical, unsymmetrical and transposed configurations –Calculation of Line constants of stranded conductor, double circuit 3-phase system using GMD and GMR Concepts.

Learning Outcomes: At the end of the unit, the student will be able to:

- Calculate Inductance of the transmission line(L3)
- Calculate Capacitance of the transmission line(L3)

Unit 2 Performance of Transmission Lines 10

Classification of Transmission Lines -Short, medium and long line and their model representations - Nominal-T, Nominal-π and A, B, C, D Constants for symmetrical networks, Numerical Problems and solutions for estimating regulation and efficiency of all types of lines. – Numerical Problems. Skin and Proximity effects, Ferranti effect, Charging Current

Learning Outcomes: At the end of the unit, the student will be able to:

- Calculate Performance of Short Transmission Line(L3)
- Calculate Performance of medium Transmission Line(L3)
- Calculate Performance of long Transmission Line(L3)

Unit 3 Mechanical Design of Overhead Transmission Line 10

Corona - factors affecting corona, critical voltages and power loss.

Overhead Line Insulators, Types of Insulators, String efficiency and Methods for improvement, voltage distribution, calculation of string efficiency, Numerical Problems.Sag and Tension Calculations: Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Stringing chart, Numerical Problems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Calculate Corona Characteristics in overhead Transmission Line(L3)
- Calculate String efficiency in overhead Transmission Line(L3)
- Calculate Sag in overhead Transmission Line(L3)

Unit 4 Underground Cables 8

Types of Cables, Construction, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables, Capacitance grading, Inter- sheath grading, Numerical Problems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Calculate Resistance, Stress & Capacitance Transmission Line(L3)
- Describe Grading of underground Cables(L2)

Unit 5 Switch Gear **10**

Fuses— Introduction-Definitions-Fuse Characteristics-Types of Fuses- Applications of HRC fuse.
Circuit Breakers: Elementary principles of arc interruption, Restriking Voltage and Recovery voltages-Average and Max. RRRV, Numerical Problems Current Chopping and Resistance Switching -Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum andSF6circuit breakers.

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss different types and applications of Fuses.(L2)
- Evaluate Prestriking Voltage, recovery voltage & RRRV(L5)
- Explain the Operating Principles of Circuit Breakers.(L2)

Prescribed Text Books:

1. M.L.Soni,P.V.Gupta, U.S.Bhatnagar,A.Chakrabarthy,-A Text Book on Power System Engineering‖,Dhanpat Rai & Co Pvt. Ltd. 1st Edition, 1999.
2. C.L.Wadhwa, -Electrical Power Systems‖, New Age International (P) Limited, Publishers,1st Edition 1998.
3. Badari Ram, D.N Viswakarma, Power System Protection and Switchgear TMH Publications.1st Edition, 2012.

Reference Books:

1. JohnJGraingerWilliamDStevenson,―PowersystemAnalysis‖,TMCCompanies,4thedition,2004
2. Hadi Saadat, ―Power System Analysis‖, 1st edition, TMH Edition.2002.
3. S. Sivanagaraju S. Satyanarayana, Electric Power Transmission and Distribution 1 st edition Pearson Education India, 2008.

Web Resources:

1. https://nptel.ac.in/courses/108/105/108105067/
2. https://nptel.ac.in/courses/108/104/108104051/
3. https://nptel.ac.in/courses/108/107/108107167/

Course Outcomes: Blooms Level of Learning

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

1. Calculate the transmission line parameters for various configurations. L4
2. Evaluate the Performance of Transmission Lines L5
3. Recognize the importance of mechanical design in transmission lines. L1
4. Evaluate parameters for underground transmission lines. L4
5. Explain Various switchgear equipment's L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A253T.1	3	3	3	-	-	-	-	-	-	-	-	3	3	-
20A253T.2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
20A253T.3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
20A253T.4	3	3	3	-	-	-	-	-	-	-	-	3	3	-
20A253T.5	3	3	2	-	-	-	-	-	-	-	-	3	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Distribution of Electrical Power
Category	PEC
Couse Code	20A25AT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To discuss the basics of Distribution system, different types of loads and their characteristics and to understand the concept of DC distribution of power in terms of voltage drop and power loss.
- To explain the concepts of AC distribution of power in terms of load voltage drop and power loss, need of protection of Distribution systems and protecting devices.
- To describe the fundamental components of Substation and bus bar arrangements.
- To explain the need of Power Factor and Voltage Control in Distribution systems
- To discuss the concept of Distribution System Planning and different planning techniques

Unit 1 Load Modeling and Characteristics 08

Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural and Industrial) and Their Characteristics.

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the Load modelling and Characteristics(L2)
- Explain the Relationship between load and loss factors (L2)
- Describe Different types of loads and characteristics (L2)

Unit 2 Classification of Distribution Systems 10

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System. Voltage Drop Calculations (Numerical Problems) In A.C. Distributors for The Following Cases: Power Factors Referred to Receiving End Voltage and With Respect to Respective Load Voltages.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the different distribution systems(L2)
- Evaluate Voltage drop calculations in AC distributors(L5)

Unit 3 Substations 08

Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar, Sectionalized Single Bus Bar, Main and Transfer Bus Bar Double Breaker – One and Half Breaker System with Relevant Diagrams.

Learning Outcomes: At the end of the unit, the student will be able to:

- Express the Importance of Substations& Classifications(L1)
- Describe Different Busbar Arrangements in Substations(L2)

Unit 4 Power Factor Improvement 08

Voltage Drop and Power-Loss Calculations: Derivation for Voltage Drop and Power Loss in Lines, Manual

Methods of Solution for Radial Networks, Three Phase Balanced Primary Lines. Causes of Low P.F -Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Numerical Problems. Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction- Economic Justification - Procedure to Determine the Best Capacitor Location.

Learning Outcomes: At the end of the unit, the student will be able to:

- Express Importance and Methods to improve power factor(L1)
- Evaluate Rating of Capacitors(L5)

Unit 5 Distribution Automation 08

Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss Distribution Automation(L2)
- Explain about SCADA, CIS, GIS, & AMR(L2)

Prescribed Text Books:

1. Electric Power Distribution Engineering, Turan Gonen, CRC Press, 3rd Edition, 2014.
2. Electric Power Distribution, A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

Reference Books:

1. Electric Power Distribution Automation, Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
2. Electrical Power Distribution Systems, V. Kamaraju, Jain Book Depot. 2012.
3. Electrical Power Systems for Industrial Plants, Kamalesh Das, JAICO Publishing House, 2008.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ee61/preview
2. https://nptel.ac.in/courses/108/107/108107112/

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Compute the various factors associated with power distribution	L3
2. Make voltage drop calculations in given distribution networks	L3
3. Learn principles of substation maintenance	L2
4. Compute power factor improvement for a given system and load	L3
5. Extrapolate the implementation of SCADA for distribution automation	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A25AT.1	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20A25AT.2	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20A25AT.3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20A25AT.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20A25AT.5	3	3	3	-	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Electrical Machine Design
Category	PEC
Couse Code	20A25BT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- To study MMF calculation and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines.
- To design stator and rotor of synchronous machines and study their thermal behavior.

Unit 1 Magnetic Circuit Design 10

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, rating of machines. Calculation of field ampere turns - air gap mmf - effect of slot and ventilating duct - active iron length - mmf for teeth - real and apparent flux densities - mmf per pole - Magnetic Leakage Calculation- Effects of Leakage. Armature Leakage – Components.

Learning Outcomes: At the end of the unit, the student will be able to:
- Discuss about choice of specific electrical and magnetic loadings.(L2)
- Design of magnetic core. .(L6)
- Describe the magnetic leakage, mmf per pole, mmf for teeth. .(L2)

Unit 2 Design of Transformer 10

Output equation for single phase and three phase transformers, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and conductor cross sectional area of Primary and secondary windings, estimation of no-load current, expression for leakage reactance and voltage regulation. Design of tank and cooling tubes (round and rectangular).

Learning Outcomes: At the end of the unit, the student will be able to:
- Develop the output equation, main core dimensions of dc machine(L6)
- Design number of poles, armature, commutator and brushes.(L6)
- Predict the performance using design values.(L4)

Unit 3 Design of DC Machines 10

Output equation, choice of specific loadings and choice of number of poles, design of Main dimensions of the DC machines, Design of armature slot dimensions, commutator and brushes, magnetic circuit -estimation of ampere turns, design of yoke and poles-main and inter poles, field windings – shunt, series and inter poles

Learning Outcomes: At the end of the unit, the student will be able to:
- Develop the output equation, choice of specific loadings and choice of number of poles. .(L6)
- Design the armature slot dimensions. Commutator and brushes, Magnetic circuit. .(L6)
- Design the yoke and poles-main and inter poles. .(L6)

Unit 4 Design of Induction Machines 10

Output equation, Choice of specific loadings, main dimensions of three phase induction motor, Stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, design of Rotor bars and end ring, design of Slip ring induction motor, estimation of No load current and leakage reactance, and circle diagram.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the choice of specific loadings, choice of length of the air gap. (L2).
- Design the Rotor bars and end ring, design of Slip ring induction motor. .(L6)
- Estimate of No load current and leakage reactance and circle diagram.(L5)

Unit 5 Design of Synchronous Machines 10

Output equation, Choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non-salient pole synchronous machines. Design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, design of the field winding, and design of rotor of non-salient pole machine

Learning Outcomes: At the end of the unit, the student will be able to:

- Estimate the Short circuit ratio, design of main dimensions, armature slots and windings.(L5)
- Design of rotor of salient pole synchronous machines. .(L6)
- Design of the field winding and design of rotor of non-salient pole machine.(L6)

Prescribed Text Books:

1. A.K Sawhney, "A Course in Electrical Machine Design", Dhanpat rai and sons, Delhi.

Reference Books:

1. M. V. Deshpande, "Design and Testing of Electrical Machines", Wheeler Publishing
2. R. K. Agarwal, "Principles of Electrical Machine Design", Essa kay Publications, Delhi
3. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London. 3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006

Web Resources:

1. http://s3.mentor.com/mechanical/MagNet-BLDC-tutorial.pdf
2. https://www.mentor.com/products/mechanical/motorsolve/dcm/motor-analysis

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the specific electrical and magnetic loadings on various machines and determine the thermal aspects.	L1
2. Design the armature and field systems of DC motor and validate the performance of designed machine.	L2
3. Design the core, yoke, windings and cooling systems of a static device and determine its operational parameters.	L3
4. Design the stator and various types of rotors for induction motor and synchronous machines to validate the given specifications.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A25BT.1	3	3	3	-	-	2	-	-	-	-	-	-	3	3
20A25BT.2	3	3	3	-	2	-	-	-	-	-	-	-	3	3
20A25BT.3	3	3	3	-	2	2	-	-	-	-	-	-	3	3
20A25BT.4	3	3	3	-	-	-	-	-	-	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Instrumentation
Category	PEC
Couse Code	20A25CT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To discuss about methods of data transmission and data acquisition system
- To describe transducers and their working principles
- To discuss about measurement of non-electrical quantities such as displacement, velocity, acceleration, force, torque etc.
- To describe the architecture details of PLC, SCADA and DCS.

Unit 1 Data Transmission and Telemetry 10

Methods of Data Transmission – General Telemetry System – Land line Telemetry System – Voltage, Current and position. Land line with feedback system. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the various methods of data transmission(L2)
- Describe the concept of modulation(L2)

Unit 2 Data Acquisition System (DAS) and Signal Analyzers 10

Analog and Digital Acquisition systems – Components of Analog DAS – Types of Multiplexing Systems: Time division and Frequency division multiplexing – Digital DAS – Block Diagram – Use of Recorders in Digital DAS – Complete data logging System – Block diagram and its working – Modern Digital DAS (Block Diagram),Wave Analyzers, spectrum analyzers.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the concept of data acquisition system(L2)
- Describe the concept of analyzers(L2)

Unit 3 Transducers 9

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of resistive, inductive and capacitor transducers, LVDT Principle; Strain gauge and its principle of operation, gauge factor, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the concept of Transducers(L2)
- Describe the working of various types of transducers(L2)

Unit 4 Measurement of Non-Electrical Quantities 8

Measurement of strain, Displacement, Velocity, Angular Velocity (DC Tachometer generator, Photoelectric tachometer), acceleration (LVDT), Force (Strain gauge, load cells and LVDT), Torque (Magneto-Strictive), Temperature (Thermocouples and Thermistor), Pressure (Resistive, Inductive, LVDT and capacitive),Flow(electromagnetic flow meter, hot wire anemometer), Liquid level (ultrasonic level gauging, resistive and inductive methods).

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the concepts related to measurement of non-electrical quantities(L2)

- Describe the concepts of strain, displacement, velocity(L2)

Unit 5 Real Time Systems, SCADA & DCS 8

Real Time Systems: PLC's: Programmable logic controllers- Organisation- Hardware details- I/O- Power supply- CPU- Standards. SACADA: Introduction, SCADA Architecture, Different Communication Protocols, Common System Components, Supervision and Control. DCS: Introduction, DCS Architecture, Local Control (LCU) architecture, Configuration of DCS, displays, redundancy concept.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the concept of PLC(L2)
- Describe the concept of SCADA(L2)
- Describe the concept of DCS(L2)

Prescribed Text Books:

1. D.V.S Murthy, Transducers and Instrumentation. Second edition, Prentice Hall of India.
2. A.K. Sawhney, A course in Electrical and Electronic Measurements and Instrumentation. Dhanpat Rai& Co, 2011 Edition
3. R.G. Jamkar, Industrial Automation using PLC, SCADA& DCS, Global education Ltd. Publication.

Reference Books:

1. D O Doeblin, Measurements Systems, Applications and Design. McGraw Hill 4th Edition.
2. A.S Morris, Principles of Measurement and Instrumentation. Pearson /Prentice Hall of India.
3. H.S.Kalsi, Electronic Instrumentation. Tata McGraw-Hill Edition, 3/e.
4. A.D Helfrick and W.D.Cooper, Modern Electronic Instrumentation and Measurement techniques. Pearson/Prentice Hall of Indi, 3rd edition.
5. T. R. Padmanabhan, Industrial Instrumentation – Principles and Design. Springer.

Web Resources:

1. https://www.youtube.com/watch?v=DAwXk77DXUM&list=PLUtfVcb-iqn_Dq6RnkCaOaLjPDu3cmxpo
2. https://www.youtube.com/watch?v=vcrae3LJEGU
3. https://www.youtube.com/watch?v=swtH_okidQc&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe the basic principles involved in the meters for measuring voltage, current, resistance, frequency and so on.	L2
2. Describe the principles of data transmission system and data acquisition system.	L2
3. Illustrate the working of advanced instruments such as logic analyzers and spectrum analyzers.	L3
4. Illustrate the principles of transducers and signal conditioning circuits used in Process control industry, manufacturing industry and Automation plants.	L3
5. Describe the working of non-electrical Quantities.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A25CT.1	3	3	3	-	2	1	-	-	-	-	3	3	3	3
20A25CT.2	3	3	3	-	3	1	-	-	-	-	3	3	3	3
20A25CT.3	3	3	3	-	3	3	1	-	-	-	3	3	3	3
20A25CT.4	3	3	3	-	3	3	3	-	-	-	3	3	3	3
20A25CT.5	3	3	3	-	3	3	3	-	-	-	3	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Renewable Energy Systems
Category	PEC
Couse Code	20A25DT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To create awareness among the students about the different types of Renewable Energy sources and emphasize its importance.

Unit 1 Renewable Energy Sources: 10

Renewable and non-renewable energy sources, Importance of renewable sources of energy, Role and Potential of renewable energy sources, Advantages of renewable energy sources Limitations of renewable energy sources, comparison of conventional and nonconventional energy sources, Principles of Solar Radiation: Environmental impact of solar power, Spectral distribution of solar radiation, the solar constant, solar radiation geometry, solar radiation on tilted surface, instruments for measuring solar radiation - pyranometer, pyrheliometer and sun shine recorder, solar radiation data.

Learning Outcomes: At the end of the unit, the student will be able to:

- Find different renewable energy sources to produce electric power(L1)
- Explain the spectral distribution of solar radiation(L2)
- Explain the solar radiation measuring instruments(L2)

Unit 2 Solar Energy Collection and Its Applications: 10

Flat plate and concentrating collectors, classification of concentrating collectors, advanced collectors. Energy Storage: necessity of energy storage methods-, Sensible, latent heat and thermo chemical storage. Solar Applications- solar heating/cooling technique, solar distillation, solar ponds and drying, photovoltaic energy conversion, solar pumping. floating solar power generation

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the basic principles of wind energy conversion systems(L2)
- Analyze the various types of wind machines(L4)
- Explain the solar applications (L2)

Unit 3 Wind Energy 10

Introduction, Wind and its Properties, site selection consideration, Basic principles of Wind Energy Conversion Systems (WECS), Parts of WECS, types of wind machines Classification of WECS, modes of wind power generation, Derivation for Power in the wind, energy storage, performance characteristics of wind machines, applications, Advantages and Disadvantages of WECS.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the basic principles of wind energy conversion systems(L2)
- Analyze the various types of wind machines(L4)

Unit 4 Ocean Energies 10

Ocean thermal energy sources, working principle, Ocean thermal energy power plant development, Closed and open cycles. Advantages. Tidal energy: tidal characteristics, principle of tidal power, types of tidal power plants, advantages and disadvantages. Wave energy: Factors affecting wave energy, wave energy conversion machines, device applications

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the principle of ocean thermal energy source(L2)
- Explain the principle of tidal power its advantage and disadvantages(L2)
- Describe the wave energy conversion machines(L2)

Unit 5 Bio-Mass and Geothermal Energy: 10

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas and economic aspects. Geothermal Energy: Geothermal field, Resources, types of wells, methods of harnessing the energy, potential in India.Fuel cell: Principle of working- various types - construction and applications.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the principle of bio conversion(L2)
- Explain the geothermal resources(L2)
- Describe the working principles of fuel cell(L2)

Prescribed Text Books:

1. G.D. Rai. Non-Conventional Energy Sources. Khanna Publishers, Delhi, 2007.
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi,2006

Reference Books:

1. Twidell &Wier, Renewable Energy Resources, CRC Press (Taylor & Francis)
2. Ramesh & Kumar, Renewable Energy Technologies, Narosa.
3. K Mittal, Non-Conventional Energy Systems, Wheeler
4. D.P.Kothari, K.C.Singhal, Renewable energy sources and emerging technologies, Prentice Hall India.
5. G.D. Rai, Solar Energy Utilization, Khanna Publishers, Delhi, 2001.
6. G.N.Tiwari and M.K. Ghosal. Fundamentals of Renewable energy resources.
7. Narosa, New Delhi, 2007.Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning.

Web Resources:

1. https://nptel.ac.in/courses/115/105/115105127/
2. https://ioe.iitm.ac.in/project/renewable-energy-systems/
3. https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/education

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe fundamentals of solar energy and the basic concepts of solar radiation and its measurements	L2
2. Describe different types of solar collectors and its applications.	L2
3. Explain design of wind energy conversion systems.	L1
4. Realize power from oceans (thermal, wave, tidal) and conversion devices	L4
5. Describe biomass conversion technologies, geo thermal resources and fundamentals of fuel cells	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A25DT.1	3	-	3	-	3	-	3	-	-		-	3	3	3
20A25DT.2	3	-	3	-	3	-	3	-	-		-	3	3	-
20A25DT.3	3	3	3	-	3	-	-	-	-		-	3	3	-
20A25DT.4	3	3	3	-	3	3	-	-	-		-	3	3	-
20A25DT.5	3	3	3	-	3	3	-	-	-		-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Water Resources and Harvesting
Category	OEC
Couse Code	20A15ET
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To familiarize students about the occupational hazards and remedial measures to say safe at work place.
- To enable students to learn the basics of the environmental management in order to make them job ready.

Unit 1 Water and wastewater **9**

Introduction – Water resources (Surface and subsurface) and its significance – Water: distribution on earth, Water quality and standards; Water pollution: Types, sources and impacts – Surface water, ground water pollution, Wastewater: Domestic – black and grey water; industrial and agricultural wastewater. Waste water treatment – Methods.

Learning Outcomes: At the end of the unit, the student will be able to:
- Know the significance of surface and sub-surface water resources.(L1)
- Know the impact of waste water on domestic, agricultural and industrial.(L1)

Unit 2 Water Resource Management **10**

Hydrological cycle, Precipitation Evaporation and condensation, Groundwater - Classification, Aquifers – types and management. Soil conservation and water recharge. Ground water management and key factors.

Learning Outcomes: At the end of the unit, the student will be able to:
- Learn the elements in hydrological cycle (L1)
- Recharge and preserve subsurface water. (L1)

Unit 3 Rainwater Harvesting **10**

Conservation and harvesting of rain. Types and design of water harvesting structures; catchments – type and methods. Rainwater harvesting-Catchment and roof top harvesting, Check dams, Artificial recharge, Farm ponds, Percolation tanks, traditional rain water harvesting structures

Learning Outcomes: At the end of the unit, the student will be able to:
- Know the difficulties in design of water harvesting structures. (L1)
- Know the rain water harvesting techniques.(L1)

Unit 4 Watershed Management **8**

Definition, watershed delineation; watershed development: concepts, objectives and need- Integrated and multidisciplinary approach for watershed management- Characteristics of watershed: size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology- Socio-economic characteristics.

Learning Outcomes: At the end of the unit, the student will be able to:
- Know Multidisciplinary approaches and characteristics for water shed managements (L1).
- Know the hydrology, hydrogeology and socio-economic characteristics. (L1).

Unit 5 Basin Management **12**

Definition, Factors affecting basin management- Preparation of land drainage schemes-Types and design of surface drainage -Controlling of soil erosion and soil characteristics; Estimation of soil loss due to erosion. Water availability assessment – Surface water and groundwater-Water demand assessment: municipal, industrial,

agricultural and environmental-Water allocation - Principles and policies, State and National water conflicts and management.

Learning Outcomes: At the end of the unit, the student will be able to:

- Know the schemes of various drainage systems (L1).
- Assess the availability of water and water demand.(L5)

Prescribed Text Books:

1. Irrigation and Water Resources Engineering- G.L. Asawa, New age international Publisher
2. Watershed management and Field manuals -FAO
3. Watershed management in India, J.V.S. Moorthy, Wiley India.
4. Hydrology & Water Resources Engg., S K Garg, Khanna Pub., Delhi.

Reference Books:

1. Hydraulics &Fluid Dynamics-P.M.Modi and S.M.Seth,Standard book house, Delhi
2. Applied Hydrology - Chow V T., McGraw-Hill, Inc
3. Irrigation, Water Resources & Water Power Engg., P N Modi, New Age Publishers.

Course Outcomes:	**Blooms Level of Learning**
At the end of the course, the student will be able to	
1. Know about various sustainable materials	L4
2. Understand the concept of sustainable buildings	L3
3. Learn to maximize the efficacy of existing processes.	L4
4. Understand the importance of HVAC	L4
5. Understand the importance of using renewable materials and ambient air quality.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A158T.1	-	1	2	-	-	-	3	-	-	-	-	1	-	-
20A158T.2	-	1	1	-	-	-	1	-	-	-	-	1	-	-
20A158T.3	-	1	1	-	-	-	1	-	-	-	-	1	-	-
20A158T.4	-	1	1	-	-	-	1	-	-	-	-	1	-	-
20A158T.5	-	1	1	-	-	-	1	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Disaster Management
Category	OEC
Couse Code	20A15FT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To enable the learner to understand how disasters occur and keep them aware about different disasters.
- To enable students to plan measures against different disasters.
- To make students familiar with the topics of crisis, disaster and emergency management techniques.

Unit 1 Introduction to disasters and Natural Disasters 9

Introduction to disasters and Natural Disasters, Definitions Of Risk, Vulnerability and Disasters and Their Relationship; Classification of Disasters; Natural Disasters; Environmental; Floods: Urban Floods; Flash Floods; Cyclones; Earthquakes; Landslides; Avalanches; Mudslides, Impacts of Natural Disasters; Important Case Studies (2006 Tsunami, Covid 19 etc.,).

Learning Outcomes: At the end of the unit, the student will be able to learn

- Various natural disasters and what their preconditions. (L1)
- Impacts of different natural disasters on different aspects of human life. (L1)

Unit 2 Manmade Disaster 10

Classification of Manmade Disasters: Preconditions Various Manmade Disasters; Impacts of Manmade Disasters; Important Case Studies (Bhopal Gas Tragedy, Fukushima Disaster, Ennore Oil Spill, Vizag Styrene Leak).

Learning Outcomes: At the end of the unit, the student will be able to

- Discern between natural and manmade disasters (L1)
- Learn about cascading disasters (L1)
- Find the reasons why manmade disasters happen and how to avert them. (L1)

Unit 3 Crisis and Emergency Management 8

Definition, scope and methods of - Crisis Management, Emergency management; Importance of emergency management.

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the importance of crisis and emergency management. (L4)
- Understand how evacuation drills are conducted and their importance. (L4)
- Devise plans for industrial monitoring and analyze various real-time disasters. (L1)

Unit 4 Disaster Risk Reduction 12

Global and national disaster trends, Common Disasters in India, Disaster management cycle–its phases; prevention, mitigation, preparedness, relief and recovery; structural and nonstructural safety and rehabilitation measures; Roles and responsibilities of government. DRR programs in India and the activities of National Disaster Management Authority

Learning Outcomes: At the end of the unit, the student will be able to

- Understand various phases in disaster management and importance of decision making (L3)
- Learn relating risk, vulnerability and capacity. (L3)
- Know various stages involved in disaster management and various disaster management authorities (L3)

Unit 5 Rehabilitation and Reconstruction 8

Post disaster situations; Rebuilding – Concepts, Types, Guiding Principles of Rehabilitation and Reconstruction Post-Disaster Story: The Tsunami Aftermath

Learning Outcomes: At the end of the unit, the student will be able to

- Understand and analyze dealing with post disaster situations. (L3)
- Learn the importance of incorporating environment in the design. (L3)
- Methods and strategies involved in rebuilding the society. (L3)

Prescribed Text Books:

1. Disaster Management, Dr. Mrinalini Pandey, 2014, Wiley India.
2. Introduction to Emergency Management, Bullock et al., 2020, Elsevier.
3. Techniques for Disaster Risk Management and Mitigation, Mohanty et al., 2020, Wiley.

Reference Books:

1. Harsh K Gupta, Disaster Management, 2003, Universities Press.
2. Larry Collins, Disaster Management and Preparedness, 2001, Lewis Publishers.
3. Li et al., Geomatics Solutions for Disaster Management, 2007, Springer International.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Know about various natural disasters and what their preconditions and impacts of different natural disasters on human life.	L1
2. Learn about cascading disasters and to find the reasons why manmade disasters happen and how to avert them.	L1, L4
3. Understand how evacuation drills are conducted and their importance, devise plans for industrial monitoring and analyze various real-time disasters.	L3
4. Learn relating risk, vulnerability and capacity and to know about various stages involved in disaster management and various disaster management authorities.	L3
5. Understand and analyze the dealing with post disaster situations and methods and strategies involved in rebuilding the society	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	POS3
20A159T.1	-	1	-	-	-	1	1	1	1	-	-	1	-	-	-
20A159T.2	-	1	-	-	-	1	1	1	1	-	-	1	-	-	-
20A159T.3	-	1	1	1	1	1	1	-	-	-	-	-	-	-	-
20A159T.4	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-
20A159T.5	1	1	1	1	-	-	1	1	-	1	-		-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Non-Conventional Sources of Energy
Category	OEC
Couse Code	20A35ET
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To grasp the role and potential of new and renewable source
- To recognize the principle, storage and applications of solar energy
- To understand the sources and potentials of wind energy and also to comprehend the Principles of Bio-Conversion of bio-mass and bio-gas uses.
- To explain the principle, working procedure and types of geothermal energy, ocean energy and tidal & wave energy.
- To know the knowledge on direct energy conversion.

Unit 1 Principles of Solar Radiation 9

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation, potential in India

Learning Outcomes: At the end of the unit, the student will be able to:

- Gain the knowledge on energy resources(L2)
- Learn the different types of measuring instruments of solar radiation(L1)

Unit 2 Solar Energy Collectors 9

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Solar Energy Storage And Applications: Different methods, Sensible, latent heat and tratified storage, solar ponds. Solar Applications solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion, potential in India.

Learning Outcomes: At the end of the unit, the student will be able to:

- Gain knowledge on different types of solar collectors(L2)
- Learn the different types of energy storage systems and applications(L1)

Unit 3 Wind Energy 8

Sources and potential in India, horizontal and vertical axis wind mills, performance characteristics, Betz criteria. Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, and economic aspects, potential in India

Learning Outcomes: At the end of the unit, the student will be able to:

- Know the different types of windmills(L1)
- Application of biomass energy(L3)

Unit 4 Geothermal Energy 10

Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principle's utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics, potential in India.

Learning Outcomes: At the end of the unit, the student will be able to:

- Gain knowledge on Geothermal & Ocean Energy(L2)
- Know the types of tidal & wave energy(L1)

- Know how to extract the energy from Geothermal & Ocean energy(L1)

Unit 5 Direct Energy Conversion 9

Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating Conditions.

Learning Outcomes: At the end of the unit, the student will be able to:

- Know basics of Direct energy conversion(L1)
- Knowledge on basics of Fuel cells (L1)

Prescribed Text Books:

1. Tiwari and MK.Ghosal, Renewable energy resources: Basic principles and applications, Narosa publications 2005, ISBN 10: 1842651250 ISBN 13: 9781842651254
2. G.D. Rai, Non-Conventional Energy Sources, khanna publications, 2011, ISBN 10: 8174090738, ISBN 13: 9788174090737

Reference Books:

1. Twidell & Weir, Renewable Energy Sources, Routledge , 3rd Ed.2015,ISBN 9780367200756
2. Non-Conventional Energy Resources, B.H.Khan, McGrawHIll, 2015, ISBN 1259081397, 9781259081392

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Create awareness on role and potential of new and renewable source and basics of solar energy.	L6
2. Acquire the knowledge on different types of collectors and storage systems of solar energy and their applications	L4
3. Achieve sufficient knowledge on Wind energy and Bio-mass energy.	L2
4. Familiarize with the Geothermal and Ocean energy concepts and their potentiality	L2
5. Gain the knowledge on direct energy conversion	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A35ET.1	3	2	-	-	-	3	3	-	-	-	-	3	-	-
20A35ET.2	3	3	-	1	3	3	-	-	-	-	-	3	-	-
20A35ET.3	3	2	3	-	-	3	3	-	-	-	-	3	-	-
20A35ET.4	3	3	-	-	3	3	-	-	-	-	-	3	-	-
20A35ET.5	3	3	-	-	3	3	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Industrial Management & Entrepreneurship
Category	OEC
Couse Code	20A35FT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To create awareness to learn principles, concepts, functions of management
- To learn the concepts of financial management.
- To learn the concepts of production, material &project management.
- To get awareness on Human Resource Management and its functions
- To analyze the need of entrepreneur development.

Unit 1 General management 10

Management definition, functions of management and principles of management. Forms of Business Organization: Salient features of Sole Proprietorship, Partnership, Joint Stock Company; Private Limited and Public Limited companies; Cooperative and Government owned companies; Merits and Demerits of above types;
Marketing Management: Functions of Marketing; Concepts of Selling and Marketing- Difference; Market Research; Product pricing; Distribution channels; Marketing mix (4 Ps); Advertising and sales promotion; Product life cycle

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain concepts of management (L2)
- Explain form Business Organization(L2)
- Discuss 4Ps of Marketing(L2)

Unit 2 Financial Management 8

Concept of time value of money; Interest formulae; Present and Future worth amounts for different cash flow patterns; Evaluation of alternative investment proposals (Capital budgeting); Types of Capital-Fixed and Working capital; Working capital management- Factors and Principles; Depreciation- Straight line depreciation, declining balance and Sum of Years digits methods

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain concepts of time value of money, depreciation(L2)
- Evaluation of investment proposals(L5)

Unit 3 Production and Materials Management 12

Functions of Production planning and control; Production Systems-Types; Inventory Control-Relevant costs, EOQ, Deterministic single item model with static demand, ABC, VED and FSN analysis; Introduction to MRP.
Project management, network modeling-probabilistic model, various types of activity-times estimation-programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method -critical path calculation-crashing of simple of networks

Learning Outcomes: At the end of the unit, the student will be able to:
- Production and Materials Management(L5)
- explain the concept of PERT(L2)
- Demonstrate Project Crashing(L3)

Unit 4 Human Resources Management 7

Concepts of HRM, Functions of personnel management, human resource planning, recruitment, selection, placement, training and development and performance appraisal. Motivation theories, leadership styles

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the concept of HRM(L2)
- Distinguish between Personnel Management and HRM(L2)
- Discuss Training and Development methods(L2)

Unit 5 Entrepreneur Development 8

Introduction, Entrepreneurial characteristics, Functions of an Entrepreneur; Factors affecting entrepreneurship, Role of communication in entrepreneurship; Entrepreneurial Development-Objectives, Need of Training for enterprises; Finance for the enterprises; Product, Process and Plant Design- Product analysis and Product Design process. Steps in process design and Plant Design

Learning Outcomes: At the end of the unit, the student will be able to:

- outline the functions of an entrepreneur(L3)
- discuss product, process & plant design(L2)

Prescribed Text Books:

1. Industrial Engineering and Operations Management, S.K.Sharma, Savita Sharma and Tushar Sharma.
2. Industrial engineering and production management, Mahajan
3. Operations Management, Joseph G Monk.

Reference Books:

1. Production, Planning and Control, Samuel Eilon.
2. Marketing Management, Phillip Kotler
3. The Essence of Small Business, Barrow colin.
4. Industrial Economics, R.R.Bharatwal
5. Financial Management I.M.Pandey.
6. Projects, Prasanna Chandra.
7. Small Industry Ram K Vepa

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the principles and practices of general management.	L2
2. Understand the various issues of financial management.	L3
3. Acquire knowledge on production and material management & concepts of PERT, CPM & Crashing of simple networks.	L4
4. Learn the functions of personnel management	L3
5. Understand the importance of entrepreneur development	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A35FT.1	3	3	-	-	-	2	-	3	3	3	-	-	-	-
20A35FT.2	3	3	-	-	-	-	-	-	-	-	2	-	-	-
20A35FT.3	3	3	-	1	-	2	-	3		3	2	-	-	-
20A35FT.4	-	-	-	-	-	-	-	3	3	3	-	2	-	-
20A35FT.5	3	3	2	-	-	2	1	3	3	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Electronic Circuits & its Applications
Category	OEC
Couse Code	20A45DT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To analyze and design the transistor and feedback amplifiers.
- To understand and analyze the concepts of oscillators

Unit 1 Single Stage Amplifiers **10**

Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model, Analysis of CE amplifier with emitter resistance and emitter follower, Miller's theorem and its dual, Design of single stage RC coupled Amplifier using BJT.

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the concepts of basic transistor amplifier circuits.(L2)
- Design and analysis of single stage amplifiers using BJTs(L6)

Unit 2 Multistage Amplifiers **10**

Analysis of Cascaded RC coupled BJT amplifiers, Cascode Amplifier, Darlington Pair, Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier.

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the purpose of cascading single stage amplifiers(L2)
- Analyze the different types of amplifiers, operation and it's characteristics.(L4)

Unit 3 Feedback Amplifiers **12**

Concept of feedback amplifiers, General characteristics of negative feedback amplifiers, effect of feedback on amplifier characteristics. Voltage series, voltage shunt, current series and current shunt feedback amplifiers with discrete components (Topologies).

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the concepts of feedback amplifiers (L2)
- Analyze the effect of negative feedback on amplifier characteristics(L4)
- Design and analysis of various feedback amplifiers(L6)

Unit 4 Oscillators **10**

Condition for oscillations, Oscillator types, Frequency and amplitude stability of oscillators, LC oscillators - Hartley and Colpitts oscillators, RC phase shift and Wein bridge oscillators, Crystal Oscillators.

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the basic principle of oscillator circuits. (L2)
- Design and Analysis of different oscillator circuits(L6)

Unit 5 Large Scale Amplifiers **8**

Classification of Power Amplifiers-Class A power Amplifiers- Direct coupled and Transformer Coupled, Class B power Amplifiers- Push-pull and Complementary Symmetry-Transistor power dissipation, Power and Efficiency calculations, Distortion of Power Amplifiers.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the concepts of different power amplifiers(L2)
- Determine the efficiencies of various power amplifiers(L3)

Prescribed Text Books:

1. 1. Millman and Christos C. Halkias- "Integrated Electronics", Mc Graw-Hill, 1972.
2. Robert T. Paynter- "Introductory Electronic Devices and Circuits", Pearson Education, 7th Edition.

Reference Books:

1. Robert L. Boylestad and Louis Nashelsky - "Electronic Devices and Circuits Theory", Pearson/Prentice Hall, 9th Edition, 2006.
2. Donald A. Neumann- "Electronic Circuit Analysis and Design", Mc Graw Hill
3. Micro Electronic Circuits Sedra and Smith, Oxford University Press

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the single stage and multi-stage amplifiers using h-parameter model at low frequencies	L4
2. Understand the feedback amplifiers and oscillators	L2
3. Analyze the concepts of large signal amplifiers	L4
4. Understand the working principle and operation of oscillators	L2
5. Analyze the concepts of large signal amplifiers	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A47ET.1	3	3	2	3	3	1	-	-	2	-	-	-	-	-
20A47ET.2	3	3	2	3	3	1	-	-	2	-	-	-	-	-
20A47ET.3	1	3	3	2	2	-	-	-	2	-	-	-	-	-
20A47ET.4	1	3	3	2	2	-	-	-	2	-	-	-	-	-
20A47ET.5	3	3	3	2	2	1	-	-	2	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Introduction to Communication Systems
Category	OEC
Couse Code	20A45ET
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To learn the fundamental concepts of Analog and Digital communication systems
- To understand the different analog and digital modulation and demodulation techniques
- To know the effect of noise in communications

Unit 1 Amplitude Modulation-I **9**

Elements of communication system, need for modulation, types of modulation, amplitude modulation single tone modulation, power relations in am waves, generation and detection of am waves

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the Elements of Analog communication system (L2)
- solve different power relations in AM (L3)

Unit 2 Amplitude Modulation - II **11**

DSB-SC: generation and detection of DSB-SC, SSB-SC: Ggeneration and detection of SSB-SC, vestigial sideband modulation: Ggeneration and detection of VSB waves.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe generation and detection methods (L2)
- Compare different Amplitude modulation methods (L4)

Unit 3 Angle Modulation **9**

Basic concepts of Frequency Modulation, Single tone frequency modulation, Narrowband FM, Wideband FM, Generation of FM Waves and Detection of FM Waves

Learning Outcomes: At the end of the unit, the student will be able to:
- Classify different angle modulation methods (L2)
- Distinguish Amplitude modulation with Angle Modulation (L2)

Unit 4 Pulse Digital Modulation **9**

Elements of digital communication system, Elements of PCM, Bandwidth requirements of PCM, Noise in PCM Systems, Differential PCM systems (DPCM), Delta modulation systems and drawbacks

Learning Outcomes: At the end of the unit, the student will be able to:
- Discuss the Elements of digital communication system (L4)
- Analyze Noise in PCM and DM (L4)
- Distinguish and Design different Modulation Schemes(L4)

Unit 5 Digital Carrier Modulation Schemes **9**

Introduction, Binary ASK Signaling Scheme-Generation and detection methods, Binary FSK Signaling Scheme-Generation and detection methods, Binary PSK Signaling Scheme-Generation and detection methods, DPSK

Learning Outcomes: At the end of the unit, the student will be able to:
- Classify and review different generation methods for Digital Modulation schemes (L2)
- Classify and review different detection methods for Digital Modulation schemes (L2)

Prescribed Text Books:

1. Simon Haykin, John Wiley-PrinciplesofCommunicationSystems,2ndEd
2. "K.Sam shanmugam" - Digital and Analog communication Systems, Wiley, 2010
3. R.P.Singh & S.D.Sapre - Communication Systems Analog & Digital, TMH, 2008

Reference Books:

1. HTaub & D.Schilling,GautamSahe-PrinciplesofCommunicationSystems,TMH,20073rd Edition
2. John Proakis - Digital Communications, TMH, 1983

Course Outcomes: Blooms Level of Learning

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

1. Recall fundamentals of Analog communication system and Demonstrate Analog modulation techniques — L2
2. Analyze Various analog modulation methods and discriminate them — L3
3. Differentiate among different angle modulation techniques — L3
4. Apply and understand Digital communication system and demonstrate digital pulse modulation techniques — L3
5. Analyze digital modulation methods and discriminate them — L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A45ET.1	3	3	3	2	-	1	-	-	-	3	-	-	-	-
20A45ET.2	3	3	3	2	-	1	-	-	-	3	-	-	-	-
20A45ET.3	3	3	3	2	-	1	-	-	-	3	-	-	-	-
20A45ET.4	3	3	3	2	-	1	-	-	-	3	-	-	-	-
20A45ET.5	3	3	3	2	-	1	-	-	-	3	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Data Structures using Python
Category	OEC
Couse Code	20A55FT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To learn basic of data structures.
- To analyze algorithms and understand sets, maps, linked list using python programming
- To apply recursion in python programming and understand hashing operation
- To learn the implementation of binary trees, binary search trees and AVL trees.

Unit 1 Introduction to Data Structures: 07
Introduction to Data structures, definition, types of data structures, Array-Based Sequences: Python's Sequence Types, Low-Level Arrays, Dynamic Arrays and Amortization, Efficiency of Python's Sequence Types, Using Array-Based Sequences, Multidimensional Data Sets.
Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the definition of data structures(L2)
- Remember various data structures(L1)

Unit 2 Linked List Structures: 11
Linked list structures: The Singly Linked List, Double linked list, Stacks. The Stack Abstract Data Type, Simple Array-Based Stack Implementation, Reversing Data Using a Stack, Queue, The Queue Abstract Data Type, Array-Based Queue Implementation
Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the linear data structure linked list(L2)
- Illustrate Abstract Data types for various data structures(L3)

Unit 3 Recursion: 09
Recursion: Recursive functions, properties of recursion, recursion works, recursive applications-recursive binary search, towers of Hanoi, exponential operation. Sorting: Merge sort, Quick sort
Learning Outcomes: At the end of the unit, the student will be able to:
- Understands the importance of recursion(L2)
- Use recursion in various examples(L3)

Unit 4 Binary Trees: 09
Binary Trees: The Tree structure, the binary search tree, The Priority Queue Abstract Data Type, Implementing a Priority Queue, heap sort.
Learning Outcomes: At the end of the unit, the student will be able to:
- Explain binary tree data structure(L2)
- Demonstrate priority queue and heap sort(L3)

Unit 5 Pattern-Matching Algorithms: 09
Pattern-Matching Algorithms: Brute Force, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Tries: Standard Tries, Compressed Tries, Suffix Tries.Graphs, Graph Traversals, Depth-First Search, Breadth-First Search.
Learning Outcomes: At the end of the unit, the student will be able to:

- describe the pattern matching algorithms(L2)
- Justify the importance of graph data structure(L5)

Prescribed Text Books:

1. Data Structures and Algorithms in Python, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Wiley Publications
2. Data Structures and Algorithms using Python, RanceD. Necaise, Wiley Publications

Reference Books:

1. Python Programming using problem solving approach, Reema Thareja, Oxford University press
2. Core Python Programming, R. Nageswara Rao, Dream Tech Press (Wiley India), 2017 Edition
3. Problem solving with algorithms and data structures using python, Bradley Miller, David L. Ranum, Franklin, Beedle& Associates incorporated, independent publishers.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Remember and understand the basics data structures.	L2
2. Illustrate Abstract Data types for various data structures	L4
3. Use recursion in different examples	L3
4. Explain binary tree, priority queue data structure	L3
5. Justify the importance of pattern matching, tires and graph data structure	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A55FT.1	3	3	3	-	-	-	-	-	-	-	-	2	-	-
20A55FT.2	3	3	3	-	-	-	-	-	-	-	-	-	-	-
20A55FT.3	3	3	3	-	3	-	-	-	-	-	-	2	-	-
20A55FT.4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
20A55FT.5	3	3	3	-	3	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Database Management Systems
Category	OEC
Couse Code	20A55GT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To understand the role and uses of DBMS in an organization.
- To understand fundamental concepts of Database Management Systems like database design, database languages, and database-system implementation.
- To construct simple and moderately advanced database queries using Structured Query Language (SQL).
- To understand and successfully apply logical database design principles, including E-R diagrams and database normalization techniques.
- To explain the principle of transaction management design.

Unit 1 Introduction: 09

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Data Storage and Querying, Transaction Management, Data Base Architecture, Database Users and Administrators, History of Database Systems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the Features of Database Management Systems, Architecture of database systems.(L2)
- Define the role of database users(L1)

Unit 2 Database Design and the Relational Model: 10

Database Design: Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model, Case study: The Internet Shop.

The Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Data Base Design: ER to Relational.

Learning Outcomes: At the end of the unit, the student will be able to:

- Develops an Entity-Relationship model based on user requirements.(L6)
- Defines the basics of the relational data model.(L1)

Unit 3 SQL and PL/SQL: 09

SQL and PL/SQL: Introduction to SQL, Data Definition Commands, Data Manipulation Commands, Select Queries, Virtual Tables: Creating View, Altering View, Updating View, Destroying View, Relational Set Operators, SQL Join Operators, Sub Queries and Correlated Queries, Aggregate Functions, Procedural SQL: Stored Procedures, Stored Functions, Triggers, Cursors.

Learning Outcomes: At the end of the unit, the student will be able to:

- Designs SQL queries to create database tables and make structural modifications.(L6)
- Define and enforces integrity constraints on a database.(L1)

Unit 4 Introduction to Schema Refinement: 12

Introduction to Schema Refinement: Problems Caused by Redundancy, Decompositions, Problems Related to Decomposition, Functional Dependencies, Reasoning about FDs, Normal Forms: 1NF, 2NF, 3NF, BCNF, Properties of Decomposition: Lossless Join Decomposition, Dependency Preserving Decomposition, Multivalued Dependencies, 4 NF.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describes Functional Dependency and Functional Decomposition.(L2)
- Applies various Normalization techniques for database design improvement.(L3)

Unit 5 ACID Properties: 09

ACID Properties: Consistency and Isolation, Atomicity and Durability, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL.

Learning Outcomes: At the end of the unit, the student will be able to:

- Applies transaction processing mechanisms in relational databases.(L3)
- Explain the Concurrency Control and Recovery Algorithms.(L2)

Prescribed Text Books:

1. Silberschatz, Korth, Sudarshan, Database System Concepts. McGraw Hill, 5th Edition.
2. C.J.Date, Introduction to Database Systems. Pearson Education.

Reference Books:

1. Raghu Rama Krishnan, Johannes Gehrke, Database Management Systems, McGraw Hill, Third Edition.
2. Elmasri, Navate, Fundamentals of Database Systems. Pearson Education.
3. Peter Rob, A. Ananda Rao, Carlos Coronel, Database Management Systems, CENGAGE Learning.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Memorize and recall the basic concepts of Database Systems to examine the applications of database systems.	L1
2. Demonstrate an Entity-Relationship (E-R) model from specifications and to convert the transformation of the conceptual model into corresponding logical data structures.	L2
3. Illustrate database concepts in structure query languages.	L3
4. Analyze the problems with redundancies and eliminate redundancies in a database schema using normalization.	L4
5. Judge the need of concurrency control in transaction management concepts in database systems.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A55GT.1	-	3	-	3	3	-	-	-	-	-	-	-	-	-
20A55GT.2	-	3	3	3	3	-	-	-	-	-	-	-	-	-
20A55GT.3	-	3	3	3	3	-	-	-	-	-	-	-	-	-
20A55GT.4	-	3	3	3	3	-	-	-	-	-	-	-	-	-
20A55GT.5	-	3	3	3	3	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Foundations of Artificial Intelligence and Data Science
Category	OEC
Couse Code	20A305GT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To comprehend the building blocks of AI in terms of intelligent agents.
- To understand the main approaches of artificial intelligence such as heuristic search, game search and logical inference.
- Fundamental knowledge of concepts underlying data science and give a hands-on experience with real-world data analysis.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
- Critically evaluate data visualizations based on their design and use for communicating stories from data

Unit 1 Introduction 9

What is AI? Foundations of AI, History of AI, Agents and environments, the nature of the Environment, structure of agents, Problem solving Agents, Problem Formulation, Uninformed Search Strategies.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understands the basics of AI and Intelligent Systems (L2)
- Represents the problem formulation in real world environment (L3)

Unit 2 Informed Search Methods 9

Informed search methods – heuristic Functions, Hill Climbing, Simulated Annealing, A*, Performance Evaluation. Constrained Satisfaction Problems: Constraint Satisfaction Problems like – map Coloring, Crypt Arithmetic, and Backtracking for CSP, Local Search. Adversarial search techniques.

Learning Outcomes: At the end of the unit, the student will be able to:

- Solves a problem for solution using state space search (L5)
- Learns different search methods for problem solving (L1)

Unit 3 Introduction to Data Science 9

What is Data Science: Big Data and Data Science hype – and getting past the hype, why now? – Deification, Current landscape of perspectives, Skill sets needed

Statistics for Data science: Populations and samples, Statistical modeling, probability distributions, fitting a model, Data Description, Probability, Distributions -Discrete and Continuous Distributions, Hypothesis testing, Regression Models – Linear and Multiple Regression models.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understands the fundamental concepts of Data Science (L2)
- Apply the statistical methods for Data science problems (L3)

Unit 4 Data exploration and Data Learning algorithms 9

Exploratory Data Analysis (EDA), Philosophy of EDA, tools for EDA, The Data Science Process, Feature Selection, Feature Generation and Extraction - Feature Selection algorithms – Filters; Wrappers.

Data Learning algorithms: Machine Learning Algorithms, Three Basic Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means – SVM, Naïve Bayes, Logistic Regression.

Learning Outcomes: At the end of the unit, the student will be able to:

- Performs Exploratory Data Analysis for feature selection and decision making. (L5)

- Understands different Data Learning algorithms (L2)

Unit 5 Data visualization 9

Data visualization and presentation: Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects.

Applications of Data science in Business, Insurance, Energy, Health care, Biotechnology, Manufacturing, Utilities, Telecommunication, Travel, Governance, Gaming, Pharmaceuticals, Geospatial analytics and modeling

Learning Outcomes: At the end of the unit, the student will be able to:

- Design visual representations for processed data (L6)
- Apply data science methods in different application domains (L3)

Prescribed Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2ndEdition, Pearson Publication.
2. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline. O'Reilly Edition, 2014.

Reference Books:

1. Rich, E. and Knight, K., "Artificial Intelligence", Tata McGraw-Hill
2. George Lugar, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education
3. Robert J. Schalkolf, Artificial Intelligence: an Engineering approach, McGraw Hill, 1990
4. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson
5. Jure Leskovek, Anand Rajaraman and Jerey Ullman. Mining of Massive Datasets. v2.1 Cambridge University Press. 2014
6. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the importance of artificial Intelligence in real world environment	L1, L2
2. Apply the artificial intelligence algorithms for problem solving	L3
3. Understand the key concepts, notations in data science and implement the standard methods of data analysis and decision making	L2, L3
4. Demonstrate the problem of knowledge extraction as combinations of data filtration, analysis and exploration methods	L3
5. Understand the importance of data visualization and the design and use of many visual components for effective communications and applications of data visualization in various domains.	L5, L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A305GT -1	3	3	-	-	-	3		-	3	2	-	2	-	-
20A305GT -2	3	3	3	3	-	3	2	-	3	-	-	2	-	-
20A305GT -3	3	-	-	-	-	-	-	-	3	-	-	3	-	-
20A305GT -4	3	3	3	-	3	-	-	-	3	-	3	3	-	-
20A305GT -5	3	3	3	-	3	-	-	-	3	3	3	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Machine Learning
Category	OEC
Couse Code	20A305HT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- Formulate machine learning problems corresponding to different applications.
- Understand machine learning algorithms along with their strengths and weaknesses.
- Understand the basic theory underlying machine learning.
- Apply machine learning algorithms to solve problems of moderate complexity.
- Understand different types of learning approaches.

Unit 1 Introduction **9**

Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

Learning Outcomes: At the end of the unit, the student will be able to:
- Explore how to build computer programs that improve their performance at some task through experience. (L4)
- Analyze sample complexity and computational complexity for several learning Problems (L4)

Unit 2 Decision Tree learning & Artificial Neural Networks **9**

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, the basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze artificial neural networks as one of the most effective learning methods currently known to interpret complex real-world sensor data (L4)
- Analyze and solves learning problem using Decision Tree (L5)

Unit 3 Bayesian learning & Genetic Algorithms **9**

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm

Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

Learning Outcomes: At the end of the unit, the student will be able to:
- Apply the principles of Probability for classification as an important area of Machine Learning Algorithms (L3)
- Illustrates the use of the genetic algorithm approach, and examine the nature of its hypothesis space search (L3)

Unit 4 Learning Sets of Rules & Analytical Learning 9

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge.

Learning Outcomes: At the end of the unit, the student will be able to:

- Analyze the Instance based algorithms can be used to overcome memory complexity and overfitting problems. (L4)
- Infer the significance of Domain Theories (L2)

Unit 5 Reinforcement Learning 9

Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

Learning Outcomes: At the end of the unit, the student will be able to:

- Infer that the combined methods outperform both purely inductive and purely analytical learning methods (L3)
- Recognize the importance of Reinforcement Learning in the industry (L1)

Prescribed Text Books:

1. Machine Learning – Tom M. Mitchell, - MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC) Reference

Reference Books:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc., 2001
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the basic knowledge about the key algorithms of machine learning	L1
2. Learn and use different machine learning algorithms	L2
3. Apply various machine learning algorithms Bayesian learning and genetic approaches	L3
4. Design the classification, pattern recognition, optimization and decision problems using machine learning algorithms	L4
5. Analyze different types of learning approaches	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A305HT.1	3	3	3	1	-	1	-	-	1	-	-	3	-	-
20A305HT.2	3	-	3	-	3	-	-	-	-	-	-	3	-	-
20A305HT.3	3	3	3	-	3	-	-	-	-	-	-	-	-	-
20A305HT.4	3	3	3	-	-	-	-	-	-	-	-	3	-	-
20A305HT.5	3	-	3	-	3	-	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Human Resource Management
Category	OEC
Couse Code	20AE5AT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- The course is designed broadly to promote understanding of procurement, development, maintenance, evaluation and overall effective utilization of manpower.

Unit 1 Introduction to Human Resource Management 10

Introduction-Definition-Nature of HRM-Scope of HRM-Functions of HRM-Managerial functions and Operative functions - Role of HRM-Personnel Management and HRM-Competitive challenges influencing HRM- Ethical aspects of HRM.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the differences between Personnel and Human resource Management (L2)
- Identify the ethical issues to be followed in the organization (L1)

Unit 2 Manpower Planning, Job Analysis and Job Design 12

Introduction to Manpower Planning- Nature of HRP-Need and Importance of HRP in Organizations-Factors affecting HRP-HRP process-Barriers to HRP- Human Resource Information System.

Job analysis: Definitions, Nature of Job analysis, process of Job analysis-methods of collecting job data.

Job design: Definition-Factors affecting Job Design-Job design Approaches.

Learning Outcomes: At the end of the unit, the student will be able to:

- Identify the need of Manpower planning in Organizations' (L1)
- Find the basic requirements of job analysis and job design (L1)

Unit 3 Recruitment and Selection of Human Capital 10

Recruitment: Nature of Recruitment-Purpose and Importance- Factors governing Recruitment-Recruitment process- Sources of Recruitment.

Selection: Nature of Selection-Selection Process- Selection tests-Barriers to effective selection.

Placement and orientation.

Learning Outcomes: At the end of the unit, the student will be able to:

- Determine the requirements of recruitment and selection (L3)
- Prepare himself when attending for different selection tests (L3)

Unit 4 Training and Development 10

Nature of Training and Development-Inputs in Training and development-Benefits of Employee Training-Training Process-Training Methods-Impediments to effective training-Career development: Definition-Initiatives-stages.

Learning Outcomes: At the end of the unit, the student will be able to:

- Extend the dynamic aspects of training and its applicability for the growth of organization(L2)
- Apply Training methods in order to make training effective(L3)

Unit 5 Evaluation and Compensation management 10

Performance Appraisal: Nature-objectives-Appraisal Process-Methods of Appraisal.

Compensation: Objectives-Objectives of Remuneration-Theories of Remuneration-Wage policy in India-Concept of Wages.

Grievance process- Importance and Approaches of Industrial relations-Collective Bargaining.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the various performance appraisal methods in an Organization(L2)
- Finds ways for evaluating compensation related pay in various organizations(L1)

Prescribed Text Books:

1. K.Aswathappa, Human Resource Management: Text and cases, The McGraw-Hill Companies, 5th Edition,.
2. P.SubbaRao, Personnel and Human Resource Management, Himalaya Publishing House, 5th Revised Edition.

Reference Books:

1. Noe A.Raymond, John Hollenbeck, Barry Gerhart and Patrick Wright, Human Resource Management, Tata Mc Graw Hill.
2. Ian Beardwell & Len Holden, Human Resource Management, Macmillan India Ltd.
3. Ivansevich, Human Resource Management, Tata McGraw Hill, 10th Edition.
4. Dessler Gary, Human Resource Management, Prentice Hall, 10th Edition.
5. Bernardi, Human Resource Management, Tata McGraw Hill, 4th Edition.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the basics of Human Resource Management.	L2
2. Know the basic requirements of Job and the way of designing the jobs in the organization.	L1
3. Apply different Recruitment and selection techniques in their practical life when attending for recruitment and selection processes.	L3
4. Get awareness of various Training and Development methods in the Organization.	L2
5. Identify various types of performance appraisal methods and compensation designs in the organization.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AE53T.1	-	-	-	-	-	-	-	2	-	-	-	3	-	-
20AE53T.2	-	-	1	-	-	-	-	-	3	-	-	3	-	-
20AE53T.3	-	-	1	-	-	-	-	-	-	-	3	3	-	-
20AE53T.4	-	-	-	-	-	-	-	3	-	-	3	-	-	-
20AE53T.5	2	-	-	-	-	-	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Intellectual Property Rights
Category	OEC
Couse Code	20AE5BT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To introduce fundamental aspects of Intellectual property rights to student who are going to play a vital role in development and management of innovative projects in industries
- To disseminate knowledge of kinds and types of intellectual property in India and abroad and registration aspects.
- To get aware of current trend in IPR and government steps in fostering IPR

Unit 1 Concept of Property 10

Meaning of Property, Kinds of property: Movable and Immovable property; Tangible and Intangible property; Intellectual property; Private and Public property. Possession and ownership.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the meaning of property and kinds of properties (L1)
- Able to distinguish between different types of properties (L4)

Unit 2 Intellectual Property Rights 10

Introduction and the need for Intellectual Property Rights (IPR), IPR in India – Genesis and Development, Forms of Intellectual Property- Copyright, Trademarks, Patents, Designs, Geographical Indicators, Merchandise, Franchise and Forms of Unfair Competition. Competing rationales of the legal regimes for the protection of Intellectual Property.

Learning Outcomes: At the end of the unit, the student will be able to:

- To get awareness of need for Intellectual Property Rights (IPR) (L1)
- To acquire knowledge in different forms of Intellectual Property- Copyright, Trademarks, Patents, Designs and Geographical Indicators (L2)

Unit 3 Copyrights & Trademarks 10

Copy Right: Meaning of Copyright, Copyright in literary, dramatic, musical work and cinematograph films Ownership, Assignment, Author's special rights, Importation and infringement, Fair use provisions. Trademarks: Definition; conception of trademarks, Registration, Distinction between trademark and property mark, Standards of proof in passing off action.

Learning Outcomes: At the end of the unit, the student will be able to:

- understand the meaning of Copyright and infringement (L1)
- find the importance of Trademarks and its registration (L1)

Unit 4 Patents, Designs and Geographical Indicators 10

Conception of Patent, Patentable Inventions, Process of obtaining a Patent: application, examination, opposition and sealing of patents; Rights and obligations of a Patentee, International Patents, Transfer of technology, know-how and problems of self-reliant development. Basic provisions related to Designs, Geographical Indicators.

Learning Outcomes: At the end of the unit, the student will be able to:

- understand the role of patent in innovation and Process of obtaining a Patent (L1)
- acquire knowledge about basic provisions related to Designs and Geographical Indicators (L2)

International Instruments Concerning Intellectual Property Rights 10

Unit 5

The Berne Convention, Universal Copyright Convention, The Paris Union, The World Intellectual Property Rights Organization (WIPO), UNESCO, TRIPS, TRIMS, and WTO.

Learning Outcomes: At the end of the unit, the student will be able to:

- Become familiar with international instruments concerning intellectual property (L2)
- Able to understand role of The World Intellectual Property Rights Organization (WIPO) and WTO in promoting IPRs(L2)

Prescribed Text Books:

1. Intellectual Property Rights: Basic Concepts, MMS Karki, Atlantic, 2009.
2. Intellectual Property Rights, Pandey, Neeraj, Dharani, Khushdeep.

Reference Books:

1. Intellectual Property Rights in India: General Isuues and Implications, Dr.Prankrishna Pal, Regal Series.
2. Intellectual Property, W.R. Cornish, Sweet & Maxwell, London, 2012.
3. Principles of Intellectual Property, N.S. Gopalakrishnan & T.G. Agitha, Eastern Book Company, Lucknow, 2009.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Gain awareness about Intellectual Property Rights (IPRs).	L2
2. Acquire adequate knowledge in the kinds of Intellectual Property Rights (IPRs).	L1
3. learn the process of patent filing and registration in India	L3
4. Learn the basic concepts of relating to copy rights, trademarks, geographical indications and others Intellectual properties.	L2
5. Gain more insights into the regulatory aspects of Intellectual Property Rights (IPRs). in India	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AE53T.1	1	1	-	-	1	-	-	-	-	-	-	-	-	-
20AE53T.2	2	-	2	-	2	-	2	-	2	-	-	1	-	-
20AE53T.3	-	2	-	-	-	2	1	3	-	2	1	-	-	-
20AE53T.4	1	-	2	-	-	-	-	1	-	-	-	-	-	-
20AE53T.5	-	1		2	-	-	-	2	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Literature and Life
Category	OEC
Couse Code	20AC5AT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	0

Course Objectives:

- Identify specific features of majorly literary genres
- Critically analyze the voices adopted by authors to convey their views on life
- Develop a style of reading and writing aligned with one' personality type
- Construct a philosophy of life as a foundation for one's growth

Unit 1 Prose **8**

- Abdul Kalam, "When I Failed"
- Chetan Bhagat, "My Stupid Suicide Plan"
- R.K. Narayan, "Toasted English

Learning Outcomes: The first module examines the hiatus between aspiration and achievement in the essays of Kalamand Bhagat, the humorous and satirical presentation of common problems in the essays of Narayan.(L3)

Unit 2 **Poetry** **8**

- W. Shakespeare, "Let me not to the marriage of true minds"
- W.H. Davies, "Leisure"
- Robert Frost, 'The Road Not Taken'

Learning Outcomes: The second module discusses the hope and faith necessary for life in the poems of Shakespeare, Davies, and Frost.(L2)

Unit 3 **Drama** **12**

- Girish Karnad's Tughlaq.

Learning Outcomes: The third module analyses the competitive, cunning, and commercial as well as political life in the play by Karnad.(L4)

Unit 4 **Drama** **12**

- Girish Karnad's Tughlaq (Contd.).

Learning Outcomes: The fourth module analyses the competitive, cunning, and commercial as well as political life in the play by Karnad.(L4)

Unit 5 **Short Story** **8**

- G G Joshi, "The Letter"
- Katherine Mansfield, "A Cup of Tea"
- J G Rosa, "The Third Bank of the River"
- Anjana Appachana, "Sharmaji"

Learning Outcomes: The fifth module considers the delicate and fragile human feelings of a father, parents, a commoner, a son, a professional, and an employee in the stories of Joshi, Mansfield, Rosa, and Appachana.(L3)

Supplementary Academic Resources:

1. Barnet, S.Burto, W., and Cain W.E. 2008. An Introduction to literature. New York: Pearson Longman.
2. Bennett, A., and Royle, N.2015.This Thing Called Literature: Reading, Thinking, Writing. London:

Routledge
3. Kusch, C.2006.Literary Analysis: The Basics.London: Routledge.
4. Watson, L.E.Ed.1951.Light From Many Lamps. New York: Simon and Schuster.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Appreciate the close relationship between literature and life	L3
2. Protect themselves against their own self-destructive thoughts	L4
3. Establish better relationships with their close and distant relatives	L3
4. Analyze the arbitrary nature of social and political structures	L3
5. Face the challenges of family and business organizations	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC5AT.1	-	-	-	-	-	-	-	3	-	-	-	3	-	-
20AC5AT.2	-	-	-	-	-	-	-	3	-	-	-	3	-	-
20AC5AT.3	-	-	-	-	-	-	-	3	-	-	-	3	-	-
20AC5AT.4	-	-	-	-	-	-	-	3	-	-	-	3	-	-
20AC5AT.5	-	-	-	-	-	-	-	3	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Linear Algebra and Numerical Analysis
Category	OEC
Couse Code	20AC5BT
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To introduce the concept of vector space.
- To introduce the concept of linear transformation.
- To learn how to apply numerical methods to solve the equations

Unit 1 Vector Space **8**

Vector spaces, Subspaces, Linear independence, Basis and dimension, Ordered basis and coordinates

Learning Outcomes: At the end of the unit, the student will be able to:
- Define Vector Space and Subspaces(L1)
- Understand the concept basis and dimensions(L2)

Unit 2 Linear transformations and Inner product spaces **12**

Linear transformations, Rank-nullity theorem (without proof), Algebra of linear transformations, Isomorphism, Matrix representation, Change of basis.

Inner products, Norms on Vector spaces, orthogonal and orthonormal sets, Gram-Schmidt process

Learning Outcomes: At the end of the unit, the student will be able to
- Define linear transformation (L1)
- Understand the concept of rank and nullity (L2)

Unit 3 Solution of simultaneous algebraic equations **10**

Iterative methods of solutions-Gauss Jacobi's method, Gauss-Seidal method, Relaxation method. Solution of non-linear simultaneous equations-Newton-Raphson method.

Learning Outcomes: At the end of the unit, the student will be able to:
- Use iteration methods to solve system of linear equations (L3)
- Apply Newton-Raphson method to solve non-linear simultaneous equations (L3)

Unit 4 Numerical solution of Partial differential Equations **10**

Introduction-Classification of second order equations, finite difference approximation to partial derivatives, Elliptic equation, solution of Laplace equation, solution of Poisson's equation.

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the concept of finite difference approximation (L2)
- Utilize the numerical methods to solve partial differential equations (L3)

Unit 5 Numerical solution of heat and wave Equations **8**

Parabolic equation, Solutions of one-dimensional heat equation (Explicit & Implicit schemes), Hyperbolic equation, solution of wave equation

Learning Outcomes: At the end of the unit, the student will be able to:
- Define heat and wave equations (L1)
- Understand the concept of explicit and implicit schemes to solve heat and wave equations (L2)

Prescribed Text Books:

1. A.R.Vasista and J.N.Sharma, Linear Algebra, Krishna Prakashan Media, 2019
2. S.Lang, Linear Algebra, 3rd Edition, Springer, 2004.
3. D.W.Lewis, Matrix Theory, World Scientific, 1991.
4. B.S.Grewal, Numerical methods in Engineering and science.9/e,Khanna Publishers,2010.

Reference Books:

1. K.Janich, Linear Algebra, Springer ,1994
2. B.Koleman and D.Hill, Elementary Linear Algebra, 9/e Pearson, 2007.
3. S.S.Sasttry, Introductory methods of numerical Analysis,7/e, PHI Publishers,2014.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Understand the concept of vector spaces.	L2
2. Understand the concept of Linear transformation	L2
3. Apply numerical methods to solve algebraic equations.	L3
4. Apply numerical techniques to solve partial differential equations	L3
5. Use numerical methods to solve engineering problems	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC5BT.1	2	2	-	-	-	-	-	-	-	-	-	2	-	-
20AC5BT.2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
20AC5BT.3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
20AC5BT.4	3	3	-	-	-	-	-	-	-	-	-	3	-	-
20AC5BT.5	2	2	-	-	-	-	-	-	-	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Constitution of India
Category MC
Couse Code 20AC52T

Year III
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	0

Course Objectives:

- To Describe the importance of the constitution
- To Describe the structure of executive, legislature, and judiciary
- To Describe the philosophy of fundamental rights and duties
- To Describe the autonomous nature of constitutional bodies like the Supreme Court and High Court, Controller and Auditor General of India and Election Commission of India.
- To Describe the union and state financial and administrative relations

Unit 1 Introduction to Indian Constitution: 08

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.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the necessity of framed rules of constitution(L2)
- Describe the process of citizenship(L2)
- Distinguish fundamental rules from fundamental duties(L2)

Unit 2 Union Government and its Administration Structure of the Indian Union: 12

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

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe administrative structure of union government(L2)
- Describe the federal nature of Indian Union(L2)
- Describe judicial structure at various levels(L2)

Unit 3 State Government and its Administration: 10

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

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the administrative structure of state government(L2)
- Know the power distribution between CM and Governor(L1)

Unit 4 Local & District Administration: 08

Local Administration - District Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Panchayati Raj: 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

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe district administrative structure(L2)

- Describe various kinds of local governance in practice(L2)
- Know the relevance of local administration in accomplishing grass-root democracy (L1)

Unit 5 Election Commission: 10

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

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the autonomous role of ECI in conducting free and fair elections(L2)
- Need of various National commissions in the uplift of weaker sections(L1)

Prescribed Text Books:

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

Reference Books:

1. J.A. Siwach, Dynamics of Indian Government & Politics
2. D.C. Gupta, Indian Government and Politics
3. M.V. Pylee, India's Constitution

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe the historical background of the constitution making and its importance for building a democratic India.	L2
2. Describe the functioning of three wings of the government, i.e., executive, legislative and judiciary.	L2
3. Describe the value of the fundamental rights and duties for becoming good citizens of India.	L2
4. Describe the decentralization of power between union, state and local self-government.	L2
5. Describe the operation of constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC52T.1	-	-	-	-	-	-	-	-	-	-	-	2	-	-
20AC52T.2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20AC52T.3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20AC52T.4	-	-	-	-	-	-	-	-	-	-	-	2	-	-
20AC52T.5	-	-	-	-	-	-	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Control Systems and Simulation Lab
Category	PCC
Couse Code	20A251L
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
- To demonstrate the basic concepts of linear control theory
- To design of control system in time response of systems and steady state error analysis
- To describe the concept of stability of control system and methods of stability analysis.

List of Experiments
Perform any ten experiments out of the following
6. Time response of Second order system
7. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
8. Effect of feedback on DC servo motor
9. Transfer function of DC Machine
10. Effect of P, PD, PI, PID Controller on a second order systems
11. Lag and lead compensation – Magnitude and phase plot
12. Temperature controller using PID
13. Characteristics of Magnetic amplifiers
14. Characteristics of Stepper motor
15. Characteristics of Synchros
16. Characteristics of AC servo motor
17. PSPICE simulation of Op-Amp based Integrator and Differentiator circuits.
18. Linear system analysis (Time domain analysis, Error analysis) using Simulation.
19. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using Simulation.
20. State space model for classical transfer function using Simulation. – Verification.
21. Effect of P-PI-PID controller on level processing unit.

Web Resources:
1. https://www.youtube.com/watch?v=DyI7OieCbxs
2. https://www.youtube.com/watch?v=6-TDhsCUIZA
3. https://www.youtube.com/watch?v=-HMhKVZ0EtQ

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Determine time response of given control system model.	L3
2. Formulate transfer function for given system.	L3
3. Analyze the effect of feedback, P, PD, PI, PID Controller on systems	L4
4. Apply Programmable logic controller	L3
5. Design Lead, Lag, Lead-Lag controllers	L4
6. Analyze Stability of a given system using different methods	L4
7. Apply concept of state space to a system	L3
8. Acquire knowledge about the characteristics of stepper motor, servo motor and synchros.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A251L.1	3	3	3	-	3	-	-	-	3	-	3	3	3	3
20A251L.2	3	3	3	-	3	-	-	-	3	-	3	3	3	3
20A251L.3	3	3	3	-	3	-	-	-	3	-	3	3	3	3
20A251L.4	3	3	3	-	3	-	-	-	3	-	3	3	3	3
20A251L.5	3	3	3	-	3	-	-	-	3	-	3	3	3	3
20A251L.6	3	3	3	-	3	-	-	-	3	-	3	3	3	3
20A251L.7	3	3	3	-	3	-	-	-	3	-	3	3	3	3
20A251L.8	3	3	3	-	3	-	-	-	3	-	3	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power Electronics and Simulation Lab
Category	PCC
Couse Code	20A252L
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
0	-	3	1.5

Course Objectives:
- Distinguish gate firing circuits & forced commutation techniques
- Analyze the operation of phase controlled converters, AC voltage controllers and Inverters
- Simulate the different power electronics converters

List of Experiments
Perform any ten experiments out of the following
1. Gate Firing Circuits for SCR's (R, RC Triggering, UJT firing circuit).
2. Forced Commutation Circuits (Class A, Class B).
3. Single Phase Half Controlled Bridge Converter with R and RL loads.
4. Single Phase Fully Controlled Bridge Converter with R and RL loads.
5. Single Phase Dual Converter with RL load.
6. Single Phase Series Inverter with R and RL loads
7. Single Phase Parallel Inverter with R and RL loads.
8. Single of Phase AC Voltage Controller with R and RL Loads
9. Simulation of Single Phase Cyclo Converter with R and RL loads.
10. Simulation of Single-Phase Fully Controlled Rectifier with R, RL & RLE loads.
11. Simulation of Single-Phase Full Bridge Inverter with PWM control.
12. Simulation of Single-Phase Full Wave AC voltage controller with R&RL loads.
13. DC Jones Chopper with R and RL Loads.

Web Resources:
1. https://www.nielit.gov.in/content/power-electronics-lab

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the firing circuits and commutation methods of SCRs	L2
2. Analyze the operation of AC/DC & DC/DC converters	L2
3. Analyze the operation of AC/AC & DC/AC converters	L2
4. Analyze the simulation circuits of various converters	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A252L.1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20A252L.2	3	3	3	3	3	3	-	-	-	-	-	-	3	3
20A252L.3	3	3	3	3	3	-	-	-	-	-	-	3	3	-
20A252L.4	3	3	3	3	3	3	-	-	-	-	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Professional Communication
Category	SC
Couse Code	20AC51L
Year	III
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:

- To describe various strategies of resume building
- To describe interview process and be prepared for facing it
- To describe group discussion techniques
- To describe about professional writing and presentations
- To be aware of managerial skills

Unit 1 Resume preparation **10**

Structure, formats and styles – planning - defining career objective - projecting one's strengths and skills - creative self-marketing - sample résumés -cover letter.

Unit 2 Interview Skill **10**

Concepts and process - pre-interview planning - preparation body language -answering strategies - frequently asked questions - mock interviews - students taking up the roles of interviewer and interviewee

Unit 3 Group Discussion **10**

Communicating views and opinions - discussing - intervening - agreeing and disagreeing – asking for and giving clarifications – substantiating - providing solutions on any given topics across a cross – section of individuals - modulations of voice and clarity - body language - case study – observation of group behaviors – social etiquette

Unit 4 Technical Report Writing and Presentation Skills (Individual and Team) **10**

Types of formats and styles, subject matter, clarity, coherence and style, planning – data collection and analysis, report preparation, preparation of figures and tables, references

Collection of data from various sources - planning, preparation, and practice - types of audience - attention-getting strategies – transitions - handling questions from audience – dealing with difficult audience

Unit 5 Interview Skills **10**

Personality traits such as integrity, accountability, assertiveness, adaptability, diplomacy and dynamism - innovative strategies for dealing with different people in different contexts - showcasing live examples, sharing anecdotes and inspiring quotes related to leadership qualities

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Express themselves fluently in social and professional contexts.	L4
2. make presentations confidently	L5
3. face interviews confidently and to participate in meetings effectively	L4
4. participate in group discussions confidently and write technical reports	L4
5. lead a team as a manager of the group	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC51L.1	-	-	-	-	-	-	-	-	-	3	-	3	-	-
20AC51L.2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
20AC51L.3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
20AC51L.4	-	-	-	-	-	-	-	-	-	3	-	3	-	-
20AC51L.5	-	-	-	-	-	-	-	-	-	3	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power System Analysis
Category	PCC
Couse Code	20A261T
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To describe the formation of Ybus and Zbus matrices for Power Systems.
- To describe the need and formulation of power flow problem.
- To model various components of power system and carry out the short circuit studies.
- To acquire basic knowledge about the dynamic mechanisms behind the synchronous machine using steady state and transient stability criterion.

Unit 1 Power System Network Modeling 12

Representation of Power System Elements, Bus Incidence matrices (A,B& C), Ybus formation by Direct and Singular Transformation Methods, Formation of ZBus: Partial network, Algorithm for the Modification of ZBus Matrix for addition of elements(Type1 to Type4 modifications) Derivations and Numerical Problems. Modification of ZBus for the changes in network (only problems).

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the representation of elements in power system.(L2)
- Obtain Bus Impedance (Zbus) and Bus admittance matrix (Ybus) for a given power system network using different methods.(L3)
- Obtain the Bus Incidence matrices for the given power system network.(L3)

Unit 2 Power Flow Studies 12

Necessity of Power Flow Studies, Data for Power Flow Studies, Derivation of Static load flow equations (Polar and Rectangular form).

Power flow solution using Gauss Seidel Method: Acceleration Factor, Load flow solution with and without P-V buses, Algorithm. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses), Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and finding Line Flows/Losses for the given Bus Voltages.

Power flow solution using Newton Raphson Method (Polar & Rectangular Form): Power Flow Solution with or without PV Buses- Derivation of Jacobian Elements, Algorithm and Flowchart.

Power flow solution using Decoupled and Fast Decoupled Method: Derivation and Numerical Load flow solution for simple 3 bus power system, Comparison of Different Methods.

Learning Outcomes: At the end of the unit, the student will be able to:

- Derive Static Load Flow equations in polar as well as in rectangular form.(L3)
- Carryout the Load flows under steady state using Gauss's Seidel, Newton Raphson, and Fast Decoupled method. (L2)
- Choose a particular load flow method for a given network. (L3)

Unit 3 Short Circuit Studies: 10

Per Unit system of representation- Per-unit equivalent reactance network of a three phase power system- Symmetrical Component Transformation, positive, negative and zero sequence components: Voltages, Currents and Impedance-Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems- Symmetrical fault analysis: Short circuit current and MVA Calculations- Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without impedance, Numerical Problems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Obtain the sequence networks of given power system under different fault conditions.(L3)
- Evaluate the Short circuit current and MVA for a symmetrical fault.(L5)
- Analyze the behavior of Power system for various faults(L4)

Unit 4 Power System Steady State Stability Analysis: 08

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Description of Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to improve steady state stability.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the elementary concepts of Steady State Stability of a Synchronous Machine.(L2)
- Discuss the role of Steady State stability limit in deciding stability.(L2)
- List out the various methods to improve steady state stability. (L1)

Unit 5 Power System Transient Stability Analysis: 08

Derivation of Swing Equation- Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion- Critical Clearing Angle Calculation - Solution of Swing equation by Point by Point method - Methods to improve Transient Stability.

Learning Outcomes: At the end of the unit, the student will be able to:

- Derive Swing Equation for a single machine system under transient disturbance.(L3)
- Apply equal area criterion to understand the stability under various transient disturbances.(L3)
- List out the various methods to improve transient stability. (L1)

Prescribed Text Books:

1. "Computer Methods in Power Systems" by Stagg & El – Abiad, Medtech Publisher,1 January 2019 Edition
2. "Modern Power system Analysis", by I.J.Nagrath & D.P.Kothari.. 4th edition. Tata McGraw-Hill Publishing Company, 2011 Edition.
3. "Electrical Power Systems" by C.L.Wadhwa, 7th Multi Color Edition, New Age International Publishers, 1 January 2016

Reference Books:

1. "Computer Techniques and Models in power systems" by K.Umararao, I.K.International Publishing house Pvt.Ltd, 2nd Edition, 2014.
2. "Power System Analysis" by John J Grainger and William D Stevenson JR,Tata McGraw Hill, New Edition 1 July 2017.
3. "Computer Techniques in Power System Analysis" by M A Pai, Dheeman Chatterjee, Tata McGraw Hill, 3rd Edition, 1 July 2017.
4. "Power System Analysis and Design" by J.Duncan Glover, Mulukutla S.Sarma and Thomas J.Overbye 4 th Edition, Nelson Engineering Publisher, 17 June 2007.
5. "Power System Analysis" by Hadi Saadat, PSA PUBLISHING LLC, 3rd Edition, 1 January 2011.

Web Resources:

1. https://nptel.ac.in/courses/108/105/108105067/
2. https://nptel.ac.in/content/storage2/courses/108106026/chapter1.pdf
3. https://www.electrical4u.com/power-system-stability/
4. https://www.youtube.com/playlist?list=PLEVP-S4VFKO9skYbAegYfSQNXNJajL3oD
5. https://www.electronicshub.org/types-of-faults-in-electrical-power-systems/

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Discuss various methods to formulate the network matrices (Ybus & Zbus) for a power system network	L3
2. Apply the iterative Load Flow Techniques to estimate steady state electrical quantities at any bus in a Power System	L3
3. Analyze the behavior of power system under different fault conditions	L4
4. Analyze the behavior of Synchronous machine under steady state stability	L2
5. Analyze the dynamics of Synchronous machine under transient stability	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A261T.1	3	3	-	-	3	-	-	-	-	-	-	-	3	-
20A261T.2	3	3	-	-	-	-	3	-	-	-	-	-	3	-
20A261T.3	3	3	-	-	3	-	-	-	-	-	-	-	3	-
20A261T.4	3	3	-	-	3	-	-	-	-	-	-	-	3	-
20A261T.5	3	3	-	-	3	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Microprocessors and Microcontrollers
Category	PCC
Couse Code	20A262T
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To describe the hardware and software details of 8086 microprocessor and 8051 micro controllers
- To explain their interfacing with memory and I/O devices
- To write assembly level programming on the above to implement real time projects.

Unit 1 8086 Architecture and Programming 10

Architecture of 8086 microprocessor, Register organization, Memory organization, Pin diagram, Minimum mode and maximum mode of operation, Timing diagrams. Machine language instruction formats, addressing modes, instruction set. Assembly language programs involving logical, branch and call instructions, sorting, string manipulation.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the Architecture and Pin diagram of 8086 Microprocessor.(L2)
- Write assembly language programs for 8086 Microprocessor.(L1)

Unit 2 Data Transfer Methods And I/O Interfacing Of 8086 10

Programmed I/O Interrupt driven I/O, DMA, Need for DMA, Architecture of 8257, Architecture of 8255 PPI and its various modes of operation. I/O Interfacing methods — I/O mapped I/O, Memory mapped I/O. 8255 interfacing to 8086, Interrupt structure of 8086, Vector interrupt table. Interrupt service routines. 8259 PIC architecture.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the Architecture of 8257 and 8255 PPI.(L2)
- Describe the different interfacing methods of 8086.(L2)

Unit 3 Communication Interface 08

Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and Interfacing to protocols like Blue-tooth and Zig-bee.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the concept of different communication methods.(L2)
- Describe the basic concepts of Blue-tooth and Zig-bee.(L2)

Unit 4 8051 Microcontroller 12

Architecture of 8051, pin diagram, memory organization, Addressing modes, instruction set, simple Programs, Timers/Counters, Serial Communication features, Interrupts.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the Architecture and Pin diagram of 8051 Microcontroller.(L2)
- Write assembly language programs of 8051 Microcontroller(L2)

Unit 5 Advanced Microcontrollers 10

The ARM Architecture, ARM7, ARM9 Features and applications of ARM. ARDUINO: Block diagram, Architecture, Pin functions, overview of main features such as I/O Ports, Timers, interrupts serial port, PWM, ADC.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the Architecture of ARM7, ARM9 and ARDUINO.(L2)

- Describe the concept of PWM and ADC.(L2)

Prescribed Text Books:

1. A.K. Ray and K.M.Bhurchandi. Advanced microprocessors and peripherals. 3rd edition. TMH. 2013.
2. Muhammad Ali Mazidi. 8051 Microcontroller and embedded systems using assembly and C. 2nd edition, Pearson Eduction. 2008.
3. Barry B.Brey The Intel microprocessors architecture, programming and interfacing 8th edition, Pearson Education. 2009.

Reference Books:

1. Douglas V.Hall. Microprocessors and Interfacing. 2ndedition,TMH, 2007

Web Resources:

1. https://nptel.ac.in/courses/108/105/108105102/
2. https://www.classcentral.com/course/swayam-microprocessors-and-microcontrollers-9894

Course Outcomes: Blooms Level of Learning

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

1. Analyze the hardware design of 8086 microprocessor and is able to write assembly language programs. L3
2. Describe the programmable (8255-PPI), non-programmable interfacing and interrupt programming of 8086 microprocessor. L2
3. Discuss the basic communication methods and communication interfacing programming of 8086 microprocessor. L2
4. Identify the difference between 8086 microprocessor based system design and 8051 microcontroller. L2
5. Analyze the advanced microcontroller based system design. L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A262T.1	3	-	-	-	3	-	-	-	-	2	-	3	3	3
20A262T.2	3	-	3	3	3	-	-	-	-	-	-	3	-	3
20A262T.3	3	-	-	2	3	-	-	-	-	2	-	3	3	-
20A262T.4	-	-	-	-	-	-	-	-	-	3	3	2	3	2
20A262T.5	-	-	3	3	3	-	-	-	-	-	3	3	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power System Operation and Control
Category	PCC
Couse Code	20A263T
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- To familiarize the students with economic operation of power systems.
- To provide knowledge about modeling of Power Plant Components.
- To prepare the students to realize the need of controlling the frequency, voltage and reactive power in a power system
- To understand different restructuring models and price indexes

Unit 1 Economic Operation: 10

Optimal Operation of Thermal Power Units, - Heat Rate Curve – Cost Curve – Incremental Fuel and Production Costs, Input-Output Characteristics, Optimum Generation Allocation with Line Losses Neglected. Optimum Generation Allocation Including the Effect of Transmission Line Losses – Loss Coefficients, General Transmission Line Loss Formula.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain Different Characteristics of Steam Plants(L2)
- Evaluate Optimum allocation of thermal plants with and without losses(L5)

Unit 2 Hydrothermal Scheduling: 10

Optimal Scheduling of Hydrothermal System: Hydroelectric Power Plant Models, Scheduling Problems-Short Term Hydrothermal Scheduling Problem. Modeling of Turbine: First Order Turbine Model, Block Diagram Representation of Steam Turbines and Approximate Linear Models. Modeling of Governor: Mathematical Modeling of Speed Governing System – Derivation of Small Signal Transfer Function – Block Diagram.

Learning Outcomes: At the end of the unit, the student will be able to:
- Discuss Different Characteristics of Hydro Plants(l2)
- Derive the transfer functions of governor, turbine & Generator – load models(L3)

Unit 3 Load Frequency Control: 08

Necessity of Keeping Frequency Constant. Definitions of Control Area – Single Area Control – Block Diagram Representation of an Isolated Power System – Steady State Analysis – Dynamic Response – Uncontrolled Case. Load Frequency Control of 2-Area System – Uncontrolled Case and Controlled Case, Tie-Line Bias Control. Proportional Plus Integral Control of Single Area and Its Block Diagram Representation, Steady State Response – Load Frequency Control and Economic Dispatch Control.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain Importance of Frequency Control(L2)
- Derive the different Responses of Single Area system and Two area systems(L3)
- Analyze the behavior of Power system for various faults(L4)

Unit 4 Reactive Power Control: 08

Overview of Reactive Power Control – Reactive Power Compensation in Transmission Systems – Advantages and Disadvantages of Different Types of Compensating Equipment for Transmission Systems; Load Compensation – Specifications of Load Compensator, Uncompensated and Compensated Transmission Lines: Shunt and Series Compensation.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain Importance of Reactive Power Control(L2)
- Describe the operation of Different compensating equipment's(L2)
- Discuss Reactive power compensation in transmission lines(L2)

Unit 5 Power System Operation in Competitive Environment: 08

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion - Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain different Restructuring models(L2)
- Discuss the Electric Marketing, price indexes, Challenges & Forecasting(L2)

Prescribed Text Books:

1. Power System Analysis Operation and Control, Abhijit Chakrabarti and Sunita Halder, PHI Learning Pvt. Ltd.,, 3rd Edition, 2010.
2. Modern Power System Analysis, D.P.Kothari and I.J.Nagrath, Tata McGraw Hill Publishing Company Ltd., 3rd Edition, 2003, Ninth Reprint 2007.

Reference Books:

1. Power System Analysis and Design, J. Duncan Glover and M.S.Sharma, Thomson, 3rd Edition, 2008.
2. Electric Energy System Theory: An Introduction, OlleIngemar Elgerd, Tata Mc Graw Hill, 2nd Edition, 1982.
3. Power System Stability and Control, P Kundur, Tata Mc Graw Hill, 1994, 5th Reprint, 2008.

Web Resources:

1. 1. https://nptel.ac.in/courses/108/101/108101040/
2. 2. https://nptel.ac.in/courses/108/104/108104052/

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Explore the significance of optimal allocation and scheduling of hydrothermal Systems	L3
2. Describe the mathematical models of turbines and governors	L2
3. Analyze the Load Frequency Control problem	L4
4. Explain how shunt and series compensation helps in reactive power control	L2
5. Discuss the issues concerned with power system operation in competitive environment	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A263T.1	3	3	3	2	-	-	-	-	-	-	-	-	3	-
20A263T.2	3	3	3	1	-	-	-	-	-	-	-	-	3	1
20A263T.3	3	3	3	3	-	-	-	-	-	-	-	-	3	2
20A263T.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20A263T.5	3	-	2	-	2	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power System Protection
Category	PEC
Couse Code	20A26AT
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To describe the principles, concepts of switchgear & protection
- To classify various types of Electromagnetic, and microprocessor-based relays.
- To discuss the protection schemes for various components under various operating conditions
- To explain Neutral grounding and protection against over voltages.

Unit 1 Introduction To Protection **09**

Need for Protective Systems, Nature and Causes of Faults, Types of Faults, Effects of Faults, Fault Statistics, Evolution of Protective Relays, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Classification of Protective Relays, Classification of Protective Schemes, Automatic Reclosing.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the Need of Protection(L2)
- Classify Protective Relays(L3)
- List the Protective schemes(L1)

Unit 2 Electromagnetic Relays, Micro-Processor Based Relays and Static Relays **13**

Electromagnetic relays: Introduction, Attracted Armature, Induction Disc Relay, Induction Cup Relay, Moving Coil Relay, differential relays and biased differential relays. Characteristics of over current, directional and distance relays (R-X). Microprocessor based relays: Introduction, Advantages and disadvantages, block diagram with flowchart- over current relays. Static relays: Introduction, merits and de-merits, operation of over current relays.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the characteristics of Electromagnetic relays.(L2)
- Describe the characteristics of the microprocessor based relays.(L2)
- Illustrate the overview of static relays.(L4)

Unit 3 Protection of Generator and Transformer **09**

Protection of generators: against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problems on Design of CTs Ratio, Buchholtz relay Protection.

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the protection of generators(L4)
- Explain the protection of transformers (L2)

Unit 4 Protection of Feeders and Transmission Lines **09**

Protection of Feeder (Radial & Ring main) using over current Relays. Protection of Transmission line – 3 Zone protection using Distance Relays, Carrier current protection, Protection of Bus bars.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain protection of feeders(L2)
- Explain protection of transmission lines(L2)
- Analyze protection of bus bars.(L4)

Unit 5 Neutral Grounding and Protection Against Over Voltages 09

Grounded and Ungrounded Systems- Effects of Ungrounded Neutral on system performance, Methods of Neutral Grounding: Solid, Resistance, Reactance and Peterson coil grounding- Grounding Practices. Protection against Over Voltages: Causes of over voltages in power systems, protection against lightning over voltages - non-linear (valve type) and metal oxide (zinc-oxide) surge arresters, surge absorbers.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the grounding concepts(L2)
- Explain the protection against over voltages (L2)

Prescribed Text Books:

1. Badari Ram, D.N Viswakarma, Power System Protection and Switchgear TMH Publications,2011
2. Sunil S Rao, Switchgear and Protection, Khanna Publishers, 4th edition, 2019.

Reference Books:

1. Y.G. Paithankar, Taylor and Francis Transmission network Protection, 2009.
2. BhuvaneshOza, Power system protection and switchgear, TMH, 2010.
3. C.L.Wadhwa, Electrical Power Systems, New Age international (P) Limited, Publishers, 6th edition, 2016
4. Christopoulos and A.Wright, Electrical power System Protection 2nd Edition, Springer International Edition.2013
5. Y.G.Paithankar and S.R.Bhide, Fundamentals of Power System Protection 2nd Edition, PHI.2010

Web Resources:

1. https://nptel.ac.in/courses/108/101/108101039/
2. https://www.electrical4u.com/protection-system-in-power-system/
3. https://en.wikipedia.org/wiki/Power_system_protection

Course Outcomes:	Blooms Level of Learning
At the end of the course, the student will be able to	
1. Outline the importance of protective systems and learn various protective schemes.	L1
2. Outline various electro-magnetic relays, numerical relays and static relays	L1
3. Apply various protection schemes to protect generators and transformers under various fault conditions.	L3
4. Apply various protection schemes to protect feeders and transmission lines under various fault conditions.	L3
5. Summarize neutral grounding and protection against over voltages	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A263T.1	-	-	3	-	-	-	-	-	-	-	-	-	2	-
20A263T.2	3	-	3	3	3	1	-	-	-	-	-	-	3	3
20A263T.3	3	3	3	3	3	3	3	-	-	-	-	-	3	3
20A263T.4	3	2	3	2	3	1	1	-	-	-	-	-	3	3
20A263T.5	1	3	3	3	3	3	3	-	-	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power Semiconductor Drives
Category	PEC
Couse Code	20A26BT
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To describe the control of DC motor drives with single phase and three phase converters
- To discuss the DC-DC converter operation
- Study control of AC motor drives with variable frequency and voltage characteristics

Unit 1 Controlled Rectifier Fed DC Motor Drives 10

Introduction to Thyristor controlled Drives, Single Phase semi and fully controlled converters connected to DC separately excited and DC series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on single phase rectifier fed DC motor drive.

Three phase semi and fully controlled converters connected to DC separately excited and DC series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems three phase rectifier fed DC motor drive.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the operation of phase controlled converters and analyze its characteristics(L2)
- Apply the concepts of phase controlled converters to solve numerical problems(L3)

Unit 2 Electrical Braking & Four Quadrant Operation of DC Drives 08

Electric Braking – Plugging, Dynamic and Regenerative Braking operations- Speed torque expressions – speed torque characteristics -Problems on Braking methods.

Introduction to Four quadrant operation – Motoring & Braking operations-Four quadrant operation of D.C motors by dual converters-Problems on Dual converter fed DC motor Drive – Closed loop operation of DC motor (Block Diagram Only).

Learning Outcomes: At the end of the unit, the student will be able to:
- Distinguish Electrical Braking methods(L2)
- Discuss Four quadrant operation of Electrical Drive(L2)

Unit 3 Control of DC Motors by Choppers 08

Single quadrant, Two –quadrant and four quadrant chopper fed DC separately excited and series motors – Continuous current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on Chopper fed DC Motors – Closed Loop operation of chopper fed DC motor drive.

Learning Outcomes: At the end of the unit, the student will be able to:
- List types of choppers (L1)
- Apply the concepts of choppers to solve numerical problems(L3)

Unit 4 Control of Induction Motor From Stator Side 10

Variable voltage characteristics - Control of Induction Motor by AC Voltage Controllers – Waveforms – speed torque characteristics- Problems on regulator fed Induction motor drive.

Variable frequency control of induction motor by Voltage source and current source inverter and cyclo converter-PWM control – Speed torque characteristics- Comparison of VSI, CSI operations – Problems on inverter fed

Induction motor drive-Closed loop operation of induction motor drives.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the speed control of Induction motor from stator side(L2)
- Distinguish VSI & CSI fed Induction motor drives(L2)

Unit 5 **Control of Induction Motor From Rotor Side & Synchronous Motor Drive** **10**

Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – speed torque characteristics – advantages - applications – problems on Slip power recovery drives. Separate control & Self control of synchronous motors –Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages - Problems .

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the speed control of Induction motor from Rotor side(L2)
- Distinguish Separate control & Self control of synchronous motors(L2)

Prescribed Text Books:

1. G K Dubey, Fundamentals of Electric Drives. Narosa Publications,2nd Edition,2010.
2. M.H.Rashid, Power Electronic Circuits, Devices and applications, PHI, 4th Edition,2014.

Reference Books:

1. M. D. Singh & K. B. Kanchandhani. Power Electronics, Tata Mc Graw Hill Publishing Company, Revised edition 2013
2. P.S.Bimbhra. Power Electronics, Khanna Publishers, 2014
3. Ned Mohan, Power Electronics, second edition, john wiley & sons Inc 2014

Web Resources:

1. https://nptel.ac.in/courses/108/104/108104140/
2. https://nptel.ac.in/courses/108/102/108102046/
3. https://swayam.gov.in/nd1_noc19_ee65/preview

Course Outcomes: At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the operation of the phase controlled converters fed DC drives	L4
2. Analyze the concept of Electrical Braking & Four quadrant operation in electrical drives.	L4
3. Analyze the operation of the Chopper fed DC drives.	L4
4. Analyze Inductions motor drives with variable voltage and variable frequency sources.	L4
5. Analyze synchronous motor drives with variable voltage and variable frequency sources.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A26BT.1	3	2	3	-	-	-	-	-	-	-	-	-	2	3
20A26BT.2	2	2	2	-	-	-	-	-	-	-	-	-	3	2
20A26BT.3	3	3	2	-	-	-	-	-	-	-	-	-	3	2
20A26BT.4	2	3	3	-	-	-	-	-	-	-	-	-	2	3
20A26BT.5	3	2	3	-	-	-	-	-	-	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Modern Control Theory
Category	PEC
Couse Code	20A26CT

Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To explain the concepts of basic and modern control system for the real time analysis and design of control systems.
- To explain the concepts of state variables analysis.
- To study and analyze nonlinear systems.
- To analyze the concept of stability for nonlinear systems

Unit 1 State Variable Analysis: 12

The concept of state – State space model of Dynamic systems – Time invariance and Linearity – Non uniqueness of state model – State diagrams for Continuous-Time State models – Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and it's properties. Complete solution of state space model due to zero input and due to zero state.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn the state and state space model for dynamic systems, time invariance and linearity(L1)
- Acquire knowledge in continuous time: state models, state equations and state transition matrix(L2)

Unit 2 Controllability and Observability 12

General concept of controllability – Controllability tests, different state transformations such as diagonalisation, Jordon canonical forms and Controllability canonical forms for Continuous-Time Invariant Systems – General concept of Observability – Observability tests for Continuous-Time Invariant Systems – Observability of different State transformation forms.

Learning Outcomes: At the end of the unit, the student will be able to:

- State the controllability and observability, diagonalisation.(L1)
- Differentiate between Jordon, canonical representation for continuous time invariant systems (L4)

Unit 3 State Feedback Controllers and Observers 12

State feedback controller design through Pole Assignment, using Ackkermans formula– State observers: Full order and Reduced order observers.

Learning Outcomes: At the end of the unit, the student will be able to:

- Determine pole assignment, ackkermans formula, state observers(L3)
- Acquire knowledge in state feedback controller design(L2)

Unit 4 Non-Linear Systems 12

Introduction – Non Linear Systems – Types of Non-Linearities – Saturation – Dead-Zone – Backlash – Jump Phenomenon etc; Linearization of nonlinear systems, Singular Points and its types– Describing function– describing function of different types of nonlinear elements, – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Stability analysis of nonlinear systems based on phase-plane method.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn about nonlinear systems, types of non-linearities, dead zone(L1)

- Determine the linearization of nonlinear systems, phase plane analysis(L3)
- Perform stability analysis of nonlinear systems based on phase plane method(L5)

Unit 5 Stability Analysis 12

Stability in the sense of Lyapunov, Lyapunov's stability, and Lypanov's instability theorems – Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method.

Learning Outcomes: At the end of the unit, the student will be able to:

- State lyapunov's stability (L1)
- Apply lyapunov's stability for linear continuous time invariant systems(L3)
- Apply variable gradient method - Krasooviski's method(L3)

Prescribed Text Books:

1. M. Gopal, Modern Control System Theory by – New Age International -2014 3rd Edition.
2. Modern Control Engineering by Choudhury, D. Roy – Prentice Hall – 2015
3. N K Sinha, Control Systems– New Age International – 4th edition 2013.

Reference Books:

1. Donald E. Kirk, Optimal Control Theory an Introduction, Prentice – Hall Network series – First edition.

Web Resources

1. https://nptel.ac.in/courses/108/103/108103007/
2. https://www.edx.org/course/introduction-to-control-system-design-a-first-look

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze basic and modern control systems	L4
2. Examine a system for its stability, controllability, and observability.	L4
3. Determine pole assignment and state observers in designing linear control systems	L6
4. Apply phase plane method in determining the stability of nonlinear systems	L3
5. Apply lyapunov's stability and Krasooviski's method in determining the stability of linear continuous time invariant systems	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A26DT.1	3	3	-	-	-	-	-	-	-	-	-	3	3	-
20A26DT.2	3	3	-	-	3	-	-	-	-	-	-	3	3	-
20A26DT.3	3	3	-	-	3	-	-	-	-	-	-	3	3	-
20A26DT.4	3	3	2	2	3	-	-	-	-	-	-	3	3	-
20A26DT.5	3	3	2	2	3	-	-	-	-	-	-	3	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Solar and Wind Energy Systems
Category	PEC
Couse Code	20A26DT
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To provide a survey of the solar energy and wind energy generation technologies
- To explain the harnessing of these resources
- To describe the control of generated power based on power electronics.

Unit 1 The Solar Resource and Solar thermal power generation 10

The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Numerical problems on solar geometry.
Solar thermal power generation: Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze solar radiation spectra(L4)
- Analyze solar geometry(L4)
- Discuss the solar thermal power generation technologies(L2)

Unit 2 Solar photovoltaic 10

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms, Converter Control.

Learning Outcomes: At the end of the unit, the student will be able to:
- Demonstrate the solar technologies(L3)
- Analyze the power electronic converters for solar systems(L4)
- Discuss MPPT(L2)

Unit 3 Physics of Wind Power 10

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics probability distributions, Wind speed and power-cumulative distribution functions, numerical problems.

Learning Outcomes: At the end of the unit, the student will be able to:
- Discuss wind physics(L2)
- Analyze wind speed statistics(L4)

Unit 4 Wind generator topologies 10

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent- Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Learning Outcomes: At the end of the unit, the student will be able to:
- Discuss the type of wind turbines(L2)
- Analyze power electronic configuration(L4)

Unit 5 Network Integration Issues **10**

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the network integration issues(L2)
- Evaluate voltage and frequency operating limits(L5)
- Analyze Fault ride-through for wind farms - real and reactive power regulation(L4)

Prescribed Text Books:

1. G.D. Rai. Non-Conventional Energy Sources. Khanna Publishers, Delhi, 2007. 2.
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi,2006
3. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.

Reference Books:

1. Twidell & Wier, Renewable Energy Resources, CRC Press, Taylor & Francis. 2008
2. T. Ackermann, Wind Power in Power Systems, John Wiley and Sons Ltd., 2005.
3. S. P. Sukhatme, Solar Energy: Principles of Thermal Collection and Storage, McGraw Hill, 1984.

Web Resources:

1. https://www.youtube.com/watch?v=mpHZWYpKDJg
2. https://www.youtube.com/watch?v=VdYtTWOQrNs
3. https://www.youtube.com/watch?v=GExTwRNkQBg
4. https://www.youtube.com/watch?v=bA-yMfHPazI
5. https://www.youtube.com/watch?v=T2lgJ5MZn2Q

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Discuss energy scenario and the consequent growth of the power generation from renewable energy sources	L2
2. Describe basic physics of wind and solar power generation.	L2
3. Analyze power electronic interfaces for wind and solar generation.	L4
4. Analyze grid integration of solar and wind energy systems	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A26CT.1	3	1	3	-	3	-	-	-	-	-	-	3	2	-
20A26CT.2	3	3	3	-	3	-	-	-	-	-	-	3	2	-
20A26CT.3	3	1	1	-	3	-	-	-	-	-	-	3	2	-
20A26CT.4	3	1	1	-	3	-	-	-	-	-	-	3	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Essence of Indian Traditional Knowledge
Category	MC
Couse Code	20AC63T
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	0

Course Objectives:

- To learn basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- To understand Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature in modern society with rapid technological advancements and societal disruptions.
- To understand Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.
- To understand Indian philosophical traditions, Indian linguistic Tradition, and Indian artistic tradition.

Unit 1 Indian Tradition: 10

Indian Tradition: Fundamental unity of India, India's heroic role in world civilization, The Indian way of life, Introduction to Indian tradition, The Scientific Outlook and Human Values.

Learning Outcomes: At the end of the unit, the student will be able to:

- Appreciate incorporated traditions in Indian culture (L3)
- Understand the value of culture and traditions in leading peaceful life(L2)
- Understand the hidden scientific outlook and imbibed human values in the Indian way of life(L2)

Unit 2 Basic Structure of Indian Knowledge System: 10

Basic structure of Indian Knowledge System: Indian Traditional Scriptures, Exposure to 4-Vedas (the Rigveda, the Yajurveda, the Samaveda and the Atharvaveda) , 4-Upvedas (Ayurveda, Dhanurveda, Gandharvaveda, Sthapatya etc.), 6-Vedangas (Shiksha, Kalp, Nirukta, Vyakaran, Jyotish), 6-Upangas (Dharmashastra, Meemansa, Puranas, Tarkashastra/Logic) etc.

Learning Outcomes: At the end of the unit, the student will be able to:

- Grasp basic structure of Indian knowledge system(L2)
- Understand the essence of Vedas and their value(L2)
- Understand the systematic classification of holy scriptures (L2)

Unit 3 Indian Knowledge System and Modern Science and Indian Traditional Health Care: 08

Indian Knowledge System and Modern Science: Relevance of Science and Spirituality, Science and Technology in Ancient India, Superior intelligence of Indian sages and scientists.

Indian Traditional Health Care: Importance and Practice of Yoga, Pranayama and other prevailing health care techniques.

Learning Outcomes: At the end of the unit, the student will be able to:

- Establish connection between Indian knowledge system and Modern science(L3)
- Understand spirituality in relation to science(L2)
- Appreciate the superior intelligence of Indian saints and scientists(L3)

Unit 4 Indian Artistic Tradition and Indian Linguistic Tradition: 08

Indian Artistic Tradition: Introduction and overview of significant art forms in ancient India such as painting, sculpture, Civil Engineering, Architecture, Music, Dance, Literature etc.

Indian Linguistic Tradition: Ancient Indian languages and literary Heritages, Phonology, Morphology, Syntax and Semantics.

Learning Outcomes: At the end of the unit, the student will be able to:

- Get an overview of significant art forms of ancient India(L1)
- Understand pioneering efforts of ancient civil engineering technology(L2)
- Trace the basic Indian linguistic tradition(L3)

Unit 5 Indian Philosophical Tradition: 10

Indian Philosophical Tradition: (Sarvadarshan)- Nyaya, Viaisheshiika, Sankhya, Yoga, Meemansa, Brief understanding of Philosophy of Charvaka, Bhagwan Mahaveer Jain, Bhagwan Buddha, Kabeer, Guru Nanak Dev and other eminent ancient Indian Philosophers.

Activities: Activities will consist of one assignment on each module, group discussions, presentations, case study on various topics based on above curriculum

Learning Outcomes: At the end of the unit, the student will be able to:

- Find the essence of Indian philosophical tradition (L1)
- Assimilate the philosophical speculations of different sects and the preachings of eminent philosophers of ancient days. (L6)

Prescribed Text Books:

1. Ajwani L.H., Immortal India, Vora & Co. Publishers, 1997.
2. Swami Jitmananda, Modern Physics and Vedanta, Bharatiya Vidya Bhavan, 2004.
3. Krishnamurthy,V. Science and Spirituality- A Vedanta Perception, Bharatiya Vidya Bhavan, 2002.
4. Sharma D.S., The Upanishads- An Anthology, Bharatiya Vidya Bhavan, 1989.
5. Raman V.V., Glimpses of Indian Heritage, Popular Prakashan,1993.

Reference Books:

1. Sivaramakrishnan, V., Cultural Heritage of India- Course Material, Bharatiya Vidya Bhavan, Mumbai, 5 th Edition, 2014.
2. Capra F., Tao of Physics, Shambhala, 2010.
3. Chaterjee S.C. and Datta D.M., An Introduction to Indian Philosophy, University of Calcutta, 1984.
4. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.
5. Jha V.N., Language, Thought and Reality.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Explain basics of Indian tradition and Indian traditional knowledge systems.	L3
2. Describe basics of Indian traditional health care, technologies and its scientific perspectives.	L3
3. Explain basics of Indian artistic, linguistic and philosophical tradition.	L3
4. Co-relate the Indian traditional knowledge in modern scientific perspective.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A26CT.1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20A26CT.2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20A26CT.3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20A26CT.4	-	-	-	-	-	-	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power System Simulation Lab
Category	PCC
Couse Code	20A261L

Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:

- To analyze the efficiency, regulation and stability of transmission system.
- To enable the students to know about different load flow techniques and fault analysis.
- To acquire the knowledge on formation of bus impedance and bus admittance matrices.
- To study the Ferranti effect and optimum loading of generators.

List of Experiments

Perform any ten experiments out of the following

1. Performance of Short/Medium Transmission Lines using Simulation
2. Computation of parameters and modeling of Long Transmission Lines using Simulation
3. Determination of GMD and GMR of a Transmission Line using Simulation
4. Formation of Admittance matrix using Direct Inspection method in Simulation
5. Formation of Impedance matrix using Zbus Building Algorithm in Simulation
6. Gauss Seidal method of Load Flow Analysis using Simulation
7. Newton Raphson method of Load Flow Analysis using Simulation
8. Decouple method of Load Flow Analysis using Simulation
9. Short Circuit Analysis for LG and LL faults using Simulation
10. Short Circuit Analysis for DLG and symmetrical faults using Simulation
11. Transient Stability Analysis of SMIB system using Equal Area Criteria in Simulation
12. Transient Stability Analysis of SMIB system using Swing equation in Simulation
13. Simulation of Power Quality Problems (Voltage Sag and Swell, Harmonics, Transients)
14. Simulation Program to find the optimum loading of generators neglecting transmission losses
15. Simulation Program to find the optimum loading of generators with penalty factor

Web Resources:

1. https://vp-dei.vlabs.ac.in/Dreamweaver/
2. https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the efficiency, regulation and stability of transmission system	L4
2. Describe the formation of Admittance and Impedance matrices	L3
3. Analyze Load Flow analysis of transmission systems	L4
4. Evaluate Symmetrical and unsymmetrical faults	L6
5. Estimate optimum loading of generators and study of Ferranti effect	L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A261L.1	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A261L.2	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A261L.3	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A261L.4	3	3	3	3	3	-	-	-	3	-	-	-	3	3
20A261L.5	3	3	3	3	3	-	-	-	3	-	-	-	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Microprocessors & Microcontrollers Lab
Category	PCC
Couse Code	20A262L
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:

- To write assembly language programming of 8086 microprocessor
- To demonstrate the programmable peripheral devices and their interfacing programs with 8086 microprocessor
- To write assembly language programming of 8051 microcontroller

List of Experiments

Perform any ten experiments out of the following

Microprocessor 8086

1. Unsigned Arithmetic Operations (Addition, Subtraction, Multiplication and Division)
2. Signed Arithmetic Operations (Addition, Subtraction, Multiplication and Division)
3. ASCII-Arithmetic Operations
4. Logical Operations
   a) Code Conversion-BCD to ASCII
   b) Packed BCD to Unpacked BCD Conversion
5. String Operations
   a) Relocate a string of 'N' words/bytes
   b) Reverse String
   c) String Insertion
   d) String Deletion
6. Ascending and Descending Order of numbers using Near Procedure, Factorial f a given number
7. Interfacing with 8255PPI
   a) DAC Interfacing: Square wave generation in I/O mode
   b) Triangular, Sinusoidal and Stair wave generation in I/O mode.
8. Stepper Motor Interfacing: Rotation in Clockwise and Anti Clockwise Rotation

Microcontroller 8051

9. Arithmetic Operations (Addition, Subtraction, Multiplication and Division)
10. Reading and Writing a Port
11. Serial Communication Implementation
12. Square Wave Generation using Timer

Web Resources:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Write assembly language programming of 8086 microprocessor	L1
2. Demonstrate the programmable peripheral devices and their interfacing programs with 8086 microprocessor	L3
3. Write assembly language programming of 8051 microcontroller	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A262L.1	3	3	-	-	3	-	-	-	-	-	-	3	3	3
20A262L.2	3	3	-	3	3	-	-	-	-	-	-	3	3	3
20A262L.3	3	3	-	-	3	-	-	-	-	-	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power Systems Lab
Category	PCC
Couse Code	20A264L
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:

- To analyze the performance relay of operation
- To demonstrate the Performance of Transmission lines
- To analyze the performance of AC machines
- To demonstrate the performance of Renewable Energy sources

List of Experiments

Perform any ten experiments out of the following

1. Characteristics of IDMT Over Current Relay (Electromagnetic Type).
2. Characteristics of Negative Phase Sequence Relay (Static Type).
3. Characteristics of Percentage biased differential Relay (static type).
4. Characteristics of Over Voltage Relay (Electromagnetic Type).
5. Characteristics of overvoltage / under voltage relay (Microprocessor Based Type).
6. Characteristics of Percentage Biased Differential Relay (Electromagnetic Type).
7. Determination of ABCD parameters of transmission lines.
8. Determination of regulation and efficiency of a transmission line
9. Ferranti effect
10. Separation of No-Load Losses of Three Phase Squirrel Cage Induction motor.
11. Equivalent Circuit of three winding transformer.
12. Power Angle Characteristics of Salient pole Synchronous machine.
13. Determination of Sub transient Reactance of Salient pole Synchronous Machine.
14. Study of Radial distribution Feeder
15. Study of Time Grading
16. Determination of Sequence Impendence of Three phase alternator.
17. L-G, L-L, L-L-G Fault Analysis of a three phase alternator.
18. Study of effect of solar panels connected In (i) series (ii) parallel (iii) series-parallel
19. Wind Speed measurement.

Web Resources:

1. https://vp-dei.vlabs.ac.in/Dreamweaver/

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the performance relay of operation	L2
2. Demonstrate the Performance of Transmission lines	L2
3. Analyze the performance of AC machines	L4
4. Demonstrate the performance of Renewable Energy sources	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A264L.1	3	3	3	3	3	3	-	-	3	-	3	3	3	3
20A264L.2	3	3	3	3	2	3	-	-	3	-	3	3	3	3
20A264L.3	3	3	3	3	2	3	-	-	3	-	3	3	3	3
20A264L.4	3	3	3	3	3	-	-	-	3	-	3	3	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Java Programming
Category	SC
Couse Code	20A564L
Year	III
Semester	II
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
1	0	2	2

Course Objectives:

- To describe the basic concepts of java programming.
- To analyze and apply concepts like packages, interfaces, and exception handling.
- To implement the multi-threading and GUI applications developed using JAVA.

Module 1 Introduction to Java **T:4, P:6**

What is Java? Install Java & Java IDE, First Java Program, Variables and Data Types in Java, Operators in Java, Flow Control Statements in Java, functions in java, arrays in java, Strings in java

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the data types, operators and control statements in Java(L2)
- Know the importance of functions, arrays and strings in Java Programming(L1)

Module 2 Object-Oriented Programming **T:3, P:6**

Object-Oriented Programming, Classes and Objects, Encapsulation, Abstraction, Inheritance, polymorphism

Learning Outcomes: At the end of the unit, the student will be able to:

- Demonstrate the importance of object-oriented programming(L3)
- Define object oriented concepts(L1)

Module 3 Packages and Interfaces: **T:3, P:6**

Packages and Interfaces: Packages, defining a Package, A Short Package Example, Access Protection, an Access Example, Importing Packages.

Abstract keyword, Interfaces: Defining an Interface, Implementing Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces, Interfaces Can Be Extended

Learning Outcomes: At the end of the unit, the student will be able to:

- Apply packages in the java programs(L3)
- Differentiate abstract class and interfaces(L4)

Module 4 Exception Handling and Multithreaded Programming: **T:4, P:8**

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, displaying a Description of an Exception, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Built-in Exceptions

Multithreaded Programming: The Java Thread Model, Thread Priorities, Synchronization, Messaging, The Thread Class and the Runnable Interface, The Main Thread, creating a Thread, Implementing Runnable, Extending Thread, Choosing an Approach, Creating Multiple Threads

Learning Outcomes: At the end of the unit, the student will be able to:

- Acquire knowledge on multithreading, exception handling and apply the same in developing real time java-based applications(L1)
- Construct and classify error and exception handling(L6)

Module 5 Generics: T:3, P:6

Generics: What Are Generics, Generics Work Only with Reference Types, A Generic Class with Two Type Parameters, The General Form of a Generic Class

JavaFX Basic Concepts, Using Image and Image View, Button, Radio Button, Checkbox, Text Field

Learning Outcomes: At the end of the unit, the student will be able to:

- Articulate the generics in java programming (L6)
- Implement JavaFX Basic Concepts in java programs(L3)

Prescribed Text Books:

1. Herbert Schildt. Java. The complete reference, TMH, 9th Edition.

Reference Books:

1. J.Nino and F.A. Hosch, An Introduction to programming and OO design using Java, John Wiley&sons.
2. Y. Daniel Liang, Introduction to Java programming, Pearson Education. 6th Edition
3. R.A. Johnson- Thomson, An introduction to Java programming and object oriented application development,

Course Outcomes: Blooms Level of Learning

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

1. Understand the importance of datatypes, operators, functions, arrays and strings in Java Programming. L2
2. apply reusability concepts like Inheritance, interfaces and packages in real time applications developed using JAVA L3
3. Relate the abstract class and interfaces in java programming L3
4. Construct and classify error and exception handling L4
5. Implement genetics and JavaFX basic concepts in java programs. L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A564L.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
20A564L.2	-	3	3	2	-	-	-	-	-	-	-	-	-	-
20A564L.3	3	3	3	2	-	-	-	-	-	-	3	3	-	-
20A564L.4	3	3	3	-	-	-	-	-	-	-	3	3	-	-
20A564L.5	3	3	3	-	-	-	-	-	-	-	3	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Restructured Power Systems
Category	PEC
Couse Code	20A27AT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To explain the importance of restructuring of Power Systems
- To Illustrate different Power Market models
- To illustrate about various power sectors in India, outline the reform initiatives taken by Indian Government, Electricity Act 2003.
- To illustrate the Concepts of OASIS Transmission Congestion
- To illustrate the function of ISO role in power market.

Unit 1 Introduction To Restructuring of Power Industry 10

Introduction: Basic concept and definitions, Privatization, Restructuring, Transmission open access, Wheeling, Deregulation, Components of deregulated system, Advantages of competitive system.

Power System Restructuring: An overview of the restructured power system, Difference between integrated power system and restructured power system, Explanation with suitable practical examples.

Learning Outcomes: At the end of the unit, the student will be able to:
- Summarize the concept of Deregulation/Restructure of Power System.(L2)
- Review the difference between integrated power system and restructured power system. (L2)

Unit 2 The Philosophy of Market Models 08

Monopoly model, Single buyer model, Wholesale competition model, Retail competition model, distinguishing features of electricity as a commodity, Four pillars of market design, Cournot, Bertrand and Stackelberg competition model.

Learning Outcomes: At the end of the unit
- Summarize the different Models of Power Market.(L2)

Unit 3 Reforms in Indian Power Sector 08

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future, Discussion of role of RLDC, NLDC and ALDC.

Learning Outcomes: At the end of the unit, the student will be able to:
- Summarize about the Indian Power Sector.(L2)
- Review the Electricity Act 2003.(L2)

Unit 4 OASIS & Congestion Management (10)

Open Access Same Time Information System (OASIS): Introduction, Structure, Functionality, Implementation, Posting of information.

Importance of Congestion Management, Effects of congestion, Classification of congestion management methods, Congestion management in normal operation, Explanation with suitable example. Total transfer capability (TTC), Available transfer capability (ATC), Transmission Reliability Margin (TRM), Capacity Benefit Margin (CBM), Existing Transmission Commitments (ETC) calculation using DC model.

Learning Outcomes: At the end of the unit, the student will be able to:
- Summarize the concept of OASIS.(L2)

- Memorize the concept of Congestion Management(L1)

Unit 5 Activities of ISO (8)

Independent System Operator (ISO) activities in pool market, Wholesale electricity market characteristics, Central auction, Single auction power pool, Double auction power pool, Market clearing and pricing, Market Power and its Mitigation Techniques, Bilateral trading, Ancillary services, Transmission Pricing.

Learning Outcomes: At the end of the unit,

- Summarize the activities of ISO in the Power Market.(L2)
- Memorize the concept of Market Power and its mitigation Techniques.(L1)

Prescribed Text Books:

1. Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, "Restructured electrical power systems: operation, trading and volatility" CRC PRESS, 2017.
2. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, "Operation of restructured power systems", Springer Pub., 2012.
3. Paranjothi, S.R. , "Modern Power Systems" Paranjothi, S.R. , New Age International, 2017.
4. Sally Hunt," Making competition work in electricity", John Willey and Sons Inc. 2002.
5. Steven Stoft, "Power system economics: designing markets for electricity", John Wiley & Sons, 1st edition, 2002.

Reference Books:

1. Loi Lei Lai, "Power System Restructuring and Deregulation", John Wiley & Sons Ltd., 2001.
2. Lorrin Philipson and H. Lee Willis, "Understanding Electric Utilities and Deregulation", Marcel Dekker Inc., New York, CRC Press, 1st edition (reprint) 2018.
3. Marija Ilic, Francisco Galiana and Lestor Fink, "Power System Restructuring Engineering & Economics", Kulwer Academic Publisher, USA, 2013.

Web Resources:

1. https://nptel.ac.in/courses/108/101/108101005/

Course Outcomes: Blooms Level of Learning

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

1. Recognize the need for restructuring of Power Systems. L1
2. Summarize the market models and mechanisms for electricity as a commodity. L2
3. Recognize the reforms in power sector focusing on Indian power sector. L2
4. Dramatize the process of open access information systems and congestion management. L2
5. Identify and generalize the functioning and planning activities of ISO. L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27AT.1	3	3	2	-	2	3	-	-	-	-	3	2	3	3
20A27AT.2	3	3	2	-	2	3	-	-	-	-	3	2	3	2
20A27AT.3	3	3	2	1	2	3	1	1	-	-	3	2	3	2
20A27AT.4	3	3	3	1	1	3	1	1	-	-	3	2	3	2
20A27AT.5	3	3	3	1	1	3	-	-	-	-	3	2	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	HVDC & FACTS
Category	PEC
Couse Code	20A27BT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To introduce the concept of HVDC Transmission system and FACTS.
- To familiarize with operation of HVDC converters and their control.
- To distinguish series & shunt compensation.

Unit 1 Introduction 10

Comparison of AC and DC Transmission systems, Applications of D.C. Transmission, Types of DC links, Typical layout of a HVDC converter station. HVDC converters, Analysis of 3-phase Bridge circuit with and without overlap.

Learning Outcomes: At the end of the unit, the student will be able to:
- Compare HVDC & AC Transmission(L4)
- List the applications of D.C Transmission.(L1)

Unit 2 Converter and HVDC Control 10

Principle of DC link control, Converter control characteristics, System control Hierarchy, Firing angle control, Current and Extinction Angle control.

Harmonics, Filters and Sources of Reactive Power:

Introduction of Harmonics, Generation of Harmonics, AC and DC Filters, Sources of Reactive power.

Modeling of DC/AC converters, Converter controller equations, Solutions of AC/DC load flow- Simultaneous approach and Sequential approach

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the Principle of DC Link control(L2)
- Identify the various filters for elimination of Harmonics.(L2)

Unit 3 Introduction to FACTS Concepts 08

FACTS concepts, Flow of power in AC parallel paths and meshed systems, Basic types of FACTS controllers, Brief description and Definitions of FACTS controllers.

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the flow of power in AC parallel paths(L4)
- Explain about the basic types of FACTS controllers(L2)

Unit 4 Static Shunt & Series Compensators 10

Objectives of shunt compensation, Methods of controllable VAR generation, Static VAR compensators, SVC and STATCOM comparison. Objectives of series compensation, Variable impedance type- Thyristor Switched Series Capacitors (TSSC), and Switching Converter type Series Compensators – Static Series Synchronous Compensator (SSSC)

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the objectives of series & shunt compensation (L2)
- Distinguish series & shunt compensators (L2)

Unit 5 Combined Compensators 10

Unified power flow controller (UPFC), Basic operating principle, Independent real and reactive power flow controller.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the operation and principle of UPFC.(L2)
- Analyze the concept of independent real and reactive power flow control in UPFC.(L4)

Prescribed Text Books:

1. Padiyar, K.R., 'HVDC transmission systems', Wiley Eastern Ltd., 2010.
2. Hingorani ,L.Gyugyi, 'Concepts and Technology of Flexible AC Transmission System', IEEE Press New York, 2000 ISBN –078033 4588.

Reference Books:

1. Padiyar K.R., 'FACTS controllers for Transmission and Distribution systems' New Age International Publishers, 1st Edition, 2007.
2. Mohan Mathur R. and Rajiv K.Varma , 'Thyristor – based FACTS controllers for Electrical Transmission systems', IEEE press, Wiley Inter science , 2002.

Web Resources:

1. http://www.nptelvideos.in/2012/11/high-voltage-dc-transmission.html
2. http://nptel.ac.in/courses/108104013/
3. https://nptel.ac.in/courses/108/107/108107114/

Course Outcomes:	Blooms Level of Learning
At the end of the course, the student will be able to	
1. Analyze the Economical & Technical aspects of AC & DC Transmission	L4
2. Analyze the Converter control characteristics & Filters for harmonics elimination.	L4
3. Identify the basic types of FACTS controllers	L4
4. Distinguish series and shunt compensation	L1
5. Analyze the operation of Unified Power Flow Controller (UPFC) with independent real and reactive power flow control	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27BT.1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20A27BT.2	3	3	-	3	-	-	-	-	-	-	-	-	3	-
20A27BT.3	3	3	3	3	3	-	-	-	-	-	-	-	-	3
20A27BT.4	3	3	3	3	3	-	-	-	-	-	-	-	-	3
20A27BT.5	3	2	3	1	1	-	-	-	-	-	-	-	-	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Electrical and Electronics Engineering

Title of the Course	Embedded Systems
Category	PEC
Couse Code	20A27CT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To describe the concepts of embedded systems.
- To apply the knowledge acquired on the design considerations

Unit 1 Microcontroller & Interfacing 8051 10

Introduction, Architecture, Register Organization, Internal and External Memory, Pin diagram, I/O port structure, addressing modes, Instruction Set, simple programs. On-Chip Peripherals-8051 Interrupt Structure, Timer/Counter features, modes and programming. MSP 430 Low power Micro Controller (A Quantitative study only). Applications- Interfacing with switches, display – LED, LCD, Stepper motor interfacing, Handling External Interrupts.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe architecture and features of Intel 8051 microcontroller (L2)
- Explain different types instruction set of 8051(L2)
- Develop assembly language programs to perform various operations using 8051(L6)
- Apply and Interface simple switches, simple LEDs and stepper motors using 8051 I/O ports(L3)

Unit 2 Introduction To Embedded Systems 10

System – Embedded Definition, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Application Areas. Overview of embedded system architecture, specialties: reliability, performance, power consumption cost, size, user interface, recent trends: processor, power, memory, operating system, communication interface, programming languages, development tools, programmable hardware.

Learning Outcomes: At the end of the unit, the student will be able to:
- Differentiate embedded system and general computing system (L4)
- Classify embedded systems based on performance, complexity and era in which they are evolved(L1)
- Discuss basic hardware and software units used in embedded system.(L2)

Unit 3 Architecture Of Embedded Systems 10

Hardware Architecture – CPU, Memory, Clock Circuitry, watch dog Timer/Reset Circuitry, chip select, I/O devices, Debug Port, Communication Interfaces, Power supply Unit. Software Architecture – Services provided by an operating System, Architecture and categories of Embedded Operating Systems, Application Software, Communication software, Process of generating Executable image.

Learning Outcomes: At the end of the unit, the student will be able to:
- Summarize different factors to be considered in the selection of memory for an embedded system(L2)
- Describe characteristics describing an embedded system(L2)

Unit 4 Communication Interfaces 10

Need for Communication interface, RS232/UART, RS 422/RS 485, USB, IEEE 1394 fire wire, IEEE 802.11, Blue tooth, I2C and CAN Bus.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain need of communication Interface (L2)
- Acquire knowledge of various communication interfacing devices used in real time systems(L1)

Unit 5 Real Time Operating System 10

Architecture of Kernel, Types of Operating Systems, Tasks and Task Scheduler, Interrupt Service Routines, Inter process Communication (IPC)– Semaphores, mutex, message queues, mailboxes, pipes, signals, event registers and timers. Off the Shelf Operating Systems Embedded Operating Systems, Real Time Operating Systems, And Handheld Operating Systems.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain about operating system and RTOS (L2)
- Summarize different features of RTOS(L2)
- Explain IPC functions to enable communication of signals, semaphores and messages from ISRs and tasks(L2)

Prescribed Text Books:

1. Tammy Noergaard "Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers", Elsevier(Singapore) Pvt.Ltd.Publications, 2005.
2. John H. Davies "MSP430 Microcontroller Basics",Elsevier Ltd Publications, Copyright 2008.

Reference Books:

1. Manuel Jiménez Rogelio,PalomeraIsidoro Couvertier "Introduction to Embedded SystemsUsing Microcontrollers and the MSP430" Springer Publications, 2014.
2. Frank Vahid, Tony D. Givargis, "Embedded system Design: A Unified Hardware/Software Introduction", John Wily & Sons Inc.2002.
3. Peter Marwedel, "Embedded System Design", Science Publishers, 2007.
4. Arnold S Burger, "Embedded System Design", CMP Books, 2002.
5. Rajkamal, "Embedded Systems: Architecture, Programming and Design", TMH Publications, Second Edition, 2008.

Web Resources:

1. https://nptel.ac.in/courses/108/102/108102045/
2. https://www.edx.org/course/embedded-systems-shape-the-world-microcontroller-i

Course Outcomes: Blooms Level of Learning

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

1. Summarize the basics of microcontrollers and their interfacing L2
2. Describe the basic concepts to design embedded applications L2
3. Recognize different programming models and their suitable Application areas. L2
4. Analyze the operation of I/O ports and different communication Protocols. L4
5. Illustrate different embedded applications L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27CT.1	2	3	-	1	1	-	-	-	-	-	-	3	1	3
20A27CT.2	3	3	-	1	2	-	-	-	-	-	-	2	1	3
20A27CT.3	2	3	2	1	1	-	-	-	-	-	-	3	3	3
20A27CT.4	3	3	1	1	2	-	-	-	-	-	-	2	3	3
20A27CT.5	3	3	1	2	2	-	-	-	-	-	-	2	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Energy Auditing and Conservation Management
Category	PEC
Couse Code	20A27DT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To summarize the students to achieve a clear conceptual understanding of technical and commercial aspects of energy conservation and energy auditing.
- To Review the Management skills and communications of Energy manager/ Energy Auditor
- Illustrate the techniques, procedures, evaluation and energy audit reporting
- To estimate/calculate power factor of systems and designing of energy efficient Motors.
- To calculate life cycle costing analysis and return on investment on energy efficient technologies.

Unit 1 Energy Conservation, Management and Environmental Issues 10

History of Energy Management, Definition and Objective of Energy Management and its importance. Need of energy management, Environmental issues, Global Warming, Climate Change Problem and, Depletion of ozone layer, Importance of Energy conservation and different schemes- Management and organization of energy conservation awareness programs. Energy Conservation in Buildings, Energy Efficiency Ratings & ECBC (Energy Conservation Building Code. Energy index, cost index, Representation of pie charts, Sankey diagrams, and load profiles.

Learning Outcomes: At the end of the unit, the student will be able to:

- Summarize the importance of Energy management and Environmental Issues in the present scenario(L2)
- Memorize about the Environmental Issues in the present scenario.(L1)

Unit 2 Energy Audit 10

Energy audit concepts, Definition, Need and Types of energy audit. Energy Audit Approach and Methodology. Systematic procedure for technical audit. Understanding energy audit costs. Duties and responsibilities of energy auditors. Energy audit instruments and their usage for auditing. Energy Instruments-wattmeter, data loggers, thermocouples, pyrometers, luxmeters, tongue testers, PLCs and applications

Report-writing, preparations and presentations of energy audit reports.

Learning Outcomes: At the end of the unit, the student will be able to:

- summarize the concepts of Energy Audit and able to (l2)
- Review and summarize the Audit done in the form of Report.(L2)

Unit 3 Demand Side Management 08

Concept and Scope of Demand Side Management, Evolution of Demand Side Management, DSM Strategy, Planning, Implementation and its application, time of day pricing, multi utility power exchange model, and time of day models for planning. Load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, Usage of energy efficient equipment.

Learning Outcomes: At the end of the unit, the student will be able to:

- Summarize the concept of Demand side Management.(L2)
- Summarize the different methods for achieving demand side management(L2)

Unit 4 Improvement of Power factor and Energy efficient design – A Practical Approach. 10

Power factor – methods of improvement, selection and location of capacitors, PF with non-linear loads, effect of harmonics on power factor, power factor motor controllers- Good lighting system design and practice, lighting

control, lighting energy audit
Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring
Learning Outcomes: At the end of the unit, the student will be able to:

- Summarize the usage of capacitor for improving the power factor(L2)
- Differentiate between Energy Efficient motor and Un efficient Motor(L4)

Unit 5 Economic Analysis methods 09

Economic analysis methods-cash flow model, time value of money, Evaluation of proposals, Simple and Discount pay-back method-average rate of return method, internal rate of return method, present value method, future value method discount rate, Savings with the Power factor correction Equipment- numerical problems.
Learning Outcomes: At the end of the unit, the student will be able to:

- Analyze the benefits of adapting energy efficient equipment's with respect to investment.(L4)
- Analyze the benefits of usage of power factor equipment. (L4)

Prescribed Text Books:

1. Amlan Chakrabarti, Energy Engineering and Management, PHI, Eastern Economy Edition, 2nd edition,2018
2. Craig B. Smith, Kelly E. Parmenter ,Energy Management Principles, Pergamon Press, New York, 2nd edition,2015
3. Hamies, Energy Auditing and Conservation; Methods, Measurements, Management & Case study, Hemisphere, Washington,1st edition (Reprint 2013)
4. Umesh Rathore, Energy management, S.K.Kataria &Sons,2nd edition,1st edition(reprint 2014)
5. Amlan Chakrabarti, Energy Engineering and Management, PHI, Eastern Economy Edition, 2nd edition, 2018

Reference Books:

1. W.R.Murphy, G.Mckay, Energy Management, Butterworths,(reprint edition)2009
2. Anil Kumar, Prakash, Prashant , Samsher , Energy Management Conservation and Audits, CRC Press,1st edition,2020
3. Archie, W Culp , Principles of Energy Conservation, McGraw Hill,1st edition
4. Ramesh Bhatia; Mohan Munasinghe; Ashok V Desai, Energy Demand: Analysis, Management and Conservation, Wiley Eastern Ltd., New Delhi,1st edition.
5. A. J. McMichael, D. H. Campbell-Lendrum, C. F. Corvalan, K. L. Ebi, A. Githeko, J. D. Scheraga, A. Woodward ·, Climate Change and Human Health Risks and Responses,1st edition 2003

Web Resources:

1. https://nptel.ac.in/courses/109/106/109106161/
2. https://beeindia.gov.in/

Course Outcomes: **Blooms Level of Learning**

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

1. Analyze Energy Management and conservation related to environmental issues. L4
2. Analyze the significance and procedure for Energy Audit. L2
3. Quantify the different types of demand-side management measures and their suitability to various energy users. L2
4. Evaluate the methods of improving energy efficiency in different electrical systems and Improvement in Power Factor L2
5. Evaluate pay back periods for energy savings equipment L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27DT.1	3	3	3	1	2	3	3	-	-	-	3	3	3	3
20A27DT.2	3	3	3	-	2	3	2	-	-	1	3	3	3	3
20A27DT.3	3	3	3	1	2	3	1	1	-	-	2	3	2	3
20A27DT.4	3	3	3	1	1	3	1	1	-	-	3	3	3	2
20A27DT.5	3	3	3	1	1	3	-	-	-	-	3	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	High Voltage Engineering
Category	PEC
Couse Code	20A27ET
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:
- To discuss about the different applications of solid, liquid gas and vacuum insulating materials
- To know about the concept of breakdown phenomenon behind the insulating materials
- To familiar about the different type of high voltages and current generations includes measurements
- To discuss the testing procedure of power apparatus and insulation co-ordinations

Unit 1 Introduction to High Voltage Engineering 11

Electric field stresses. Gas/ Vacuum as insulator, Liquid dielectrics. Solids and composites, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cables, power capacitors.

Learning Outcomes: At the end of the unit, the student will be able to:
- Know the over voltage impacts on the insulating materials (L1)
- Discuss the applications of insulating materials in high power appliances.(L2)

Unit 2 Breakdown in Dielectric Materials 11

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 liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics.

Learning Outcomes: At the end of the unit, the student will be able to:
- Know basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.(L1)

Unit 3 Generation & Measurement of High Voltages and Currents: 11

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators. Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

Learning Outcomes: At the end of the unit, the student will be able to:
- Know the generation techniques of High DC, AC & Impulse voltages (L1)
- Discus various methodologies and technique to measure high voltage and high current.(L2)

Unit 4 Over voltages and insulation Co-ordination 9

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Learning Outcomes: At the end of the unit, the student will be able to:
- Discuss the causes of surges in power systems.(L2)
- Know the coordination principle of the insulating materials on the power systems(L1)

Unit 5 Testing of Materials & Electrical Apparatus 10

Measurement of D.C 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.

Learning Outcomes: At the end of the unit, the student will be able to:

- Know the impact of non-descriptive testing methodology related to insulating materials (L1)
- Discuss the concept of testing procedures followed in electrical apparatus.(L2)

Prescribed Text Books:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju, TMH Publications. 6thed, 2020
2. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Ltd. 4thed, 2020
3. High Voltage Electrical Insulation Engineering by Ravindra Arora, Wolfgang New Age Internationals, 2011

Reference Books:

1. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl,by Elsevier.2nd ed, 2000
2. High Voltage Engineering, Theory and Practice Ahdan El-Morshedy, Morcel DekkelInc, 2nd ed, 2000

Web Resources:

1. https://nptel.ac.in/courses/108/104/108104048/

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe the general aspects of electrical testing methods	L2
2. Describe the breakdown phenomenon of insulating materials	L2
3. Distinguish the different type of High voltage and current generations	L2
4. Demonstrate the significance of high voltage based testing procedures in electrical apparatus	L3
5. Discuss the need and procedures of insulation coordination	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27ET.1	3	2	1	1	-	-	-	-	-	-	-	-	2	1
20A27ET.2	3	1	2	1	-	-	-	-	-	-	-	-	2	2
20A27ET.3	3	2	2	1	-	-	-	-	-	-	-	1	2	2
20A27ET.4	3	2	1	2	-	-	-	-	-	-	-	1	2	2
20A27ET.5	3	2	2	2	-	-	-	-	-	-	-	1	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Hybrid Electric Vehicles
Category	PEC
Couse Code	20A27FT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- To analyze various electric drives suitable for hybrid electric vehicles.
- To list the energy storage technologies used for hybrid electric vehicles and their control.

Unit 1 Introduction to Electric Vehicles 10

Introduction – History of hybrid and electric vehicle -Components of EV System – EV Advantages – Vehicle Mechanics – Performance of EVs – Electric Vehicle drive train– EV Transmission Configurations and components- Tractive Effort in Normal Driving – Energy Consumption – Types of Electric Vehicle in Use Today – Electric Vehicles for the Future.

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the operation of Electric vehicles (L4)
- Discuss hybrid vehicle configuration and it's components (L2)

Unit 2 Electric Vehicle Modelling 10

Consideration of Rolling Resistance – Transmission Efficiency – Consideration of Vehicle Mass – Tractive Effort – Modelling Vehicle Acceleration – Modelling Electric Vehicle Range -Aerodynamic Considerations – Ideal Gearbox Steady State Model – EV Motor Sizing – General Issues in Design

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the electrical vehicles modeling(L2)
- Apply the concepts of tractive power to solve numerical problems. (L3)

Unit 3 Energy sources 10

Electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. Battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Li-polymer battery.

Learning Outcomes: At the end of the unit, the student will be able to:
- Identity power sources for electric vehicles (L1)
- Classify the batteries for electric vehicles. (L1)

Unit 4 Hybrid Electric Vehicles 10

HEV Fundamentals -Architectures of HEVs- Interdisciplinary Nature of HEVs – State of the Art of HEVs – Advantages and Disadvantages – Challenges and Key Technology of HEVs – Concept of Hybridization of the Automobile-Plug-in Hybrid Electric Vehicles – Design and Control Principles of Plug-In Hybrid Electric Vehicles .

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the plug-in hybrid electric vehicle design and control(L4)
- Identify the challenges of hybrid electric vehicles (L1)

Unit 5 Electric and hybrid vehicle – Case studies 10

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study –Toyota Prius,

Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy-duty vehicles, fuel cell heavy duty vehicles.

Learning Outcomes: At the end of the unit, the student will be able to:

- List the various electric and hybrid vehicles(L1)
- Discuss lightly hybridized vehicles (L2)
- Distinguish hybrid electric heavy-duty vehicles and fuel cell heavy duty vehicles. (L2)

Prescribed Text Books:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles – Fundamentals, Theory and Design – Mehrdad Ehsani, Uimin Gao and Ali Emadi – Second Edition – CRC Press, 2010
2. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
3. Electric Vehicle Technology Explained – James Larminie, John Lowry – John Wiley & Sons Ltd, – 2003.
4. Electric & Hybrid Vehicles – Design Fundamentals – Iqbal Hussain, Second Edition, CRC Press, 2011.

Reference Books:

1. Hybrid electric Vehicles Principles and applications With practical perspectives -Chris Mi, Dearborn – M. Abul Masrur, David Wenzhong Gao – A John Wiley & Sons, Ltd., – 2011
2. Review of Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles – Murat Yilmaz, and Philip T. Krein, – IEEE transactions on power electronics, vol. 28, no. 5, May 2013
3. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.

Web Resources:

1. https://nptel.ac.in/courses/108/106/108106170/
2. https://nptel.ac.in/courses/108/102/108102121/
3. https://nptel.ac.in/courses/108/103/108103009/
4. https://nptel.ac.in/courses/108/106/108106182/

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Explain the operation of hybrid electric vehicles	L2
2. Identify suitable drive for developing hybrid and electric vehicles depending on resources	L3
3. List the energy storage technologies used for hybrid electric vehicles.	L2
4. Describe Plug-in hybrid electrical vehicles	L3
5. Discuss various hybrid electrical vehicles for usage	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27FT.1	-	2	-	3	-	-	2	-	-	-	-	-	2	-
20A27FT.2	3	-	-	2	-	3	-	-	-	-	-	-	2	-
20A27FT.3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
20A27FT.4	-	3	-	2	-	-	-	-	-	-	-	-	-	-
20A27FT.5	3	-	-	3	-	-	2	-	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Programmable Logic Controller
Category	PEC
Couse Code	20A27GT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- It is to provide and ensure a comprehensive understanding of using advanced controllers in measurement and control instrumentation.
- To illustrate about data acquisition – process of collecting information from field instruments.
- To analyze Programmable Logic Controller (PLC), IO Modules and internal features.
- To Comprehend Programming in Ladder Logic, addressing of IO.
- To apply PID and its Tunning.

Unit 1 Introduction to PLC **10**

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn basics of PLC systems.(L1)
- Learn how to connect the devices to I/O modules(L1)

Unit 2 PLC Programming instructions and Ladder Diagrams **10**

Processor Memory Organization, Program Scan, PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn Processor Memory Organization.(L1)
- Learn the programming formats and Construction of PLC Ladder diagrams.(L1)

Unit 3 PLC Registers and Counters **10**

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters, counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn PLC Registers and functions .(L1)
- Learn counters and number conversion functions for industrial applications. (L1).

Unit 4 Data handling functions **10**

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn Data handling functions and their applications.(L1)
- Learn controlling of multiple axes Robots with PLC .(L1)

Unit 5 Analog PLC operation **10**

Analog PLC operation: Analog modules and systems Analog signal processing multi bitdata processing, analog

output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn Analog Signal processing with multibit data processing. .(L1)
- Apply analog output to different applications like PID Tuning and PID Modules (L3)

Prescribed Text Books:

1. Programmable Logic Controllers – Principle and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI
2. Digital Design by Morris Mano, PHI, 3rd Edition 2006.
3. Programmable Logic Controllers – Principle and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI

Reference Books:

1. Programmable logic Controllers, Frank D. Petruzella, 4th Edition, McGraw Hill Publishers.
2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth & F.D Hackworth Jr. – Pearson, 2004.
3. Programmable logic controllers and their Engineering Applications, 2nd Edition, Alan

Web Resources:

1. https://nptel.ac.in/courses/112/103/112103174/
2. http://www.eng.utoledo.edu/~wevans/chap12_S.pdf
3. http://ee.ump.edu.my/hazlina/teaching_PLC/teaching_PLC_chap3.pdf
4. https://www.philadelphia.edu.jo/academics/ttutunji/uploads/PLC%20Programming.pdf
5. http://www.infoplc.net/files/descargas/rockwell/infoplc_net_plc_analog.pdf
6. http://jjackson.eng.ua.edu/courses/ece485/lectures/LECT06.pdf
7. http://jjackson.eng.ua.edu/courses/ece485/lectures/LECT04.pdf

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Describe the main functional units in a PLC and be able to explain how they interact.	L2
2. Illustrate the different bus types used in automation industries.	L2
3. Develop ladder logic programming for simple process.	L3
4. Analyze the Data handling functions and their applications	L4
5. Apply the concepts of Analog signal processing for different applications in real time.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27GT.1	3	-	-	-	3	-	-	-	-	-	-	3	3	3
20A27GT.2	3	-	2	2	3	-	-	-	-	-	-	3	-	3
20A27GT.3	3	-	-	2	3	-	-	-	-	-	-	3	3	-
20A27GT.4	-	-	-	-	3	-	-	-	-	-	2	3	3	3
20A27GT.5	-	-	2	2	3	-	-	-	-	-	2	3	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Utilization of Electrical Energy
Category	PEC
Couse Code	20A27HT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To study the characteristics of various electric drives.
- To study the methods of electric heating and welding.
- To design simple lighting scheme for street and flood lighting.
- To study the electric traction systems.
- To study about the electric and hybrid electric vehicles.

Unit 1 Electric Drives **10**

Block diagram of electrical drive system, Advantages of electrical drives – Classification of drives –starting and running characteristics of Motor, Motor power rating for variable loads - Temperature rise – Particular applications of electric drives - Types of industrial loads: Continuous, Intermittent and Variable loads - Load equalization.

Learning Outcomes: At the end of the unit, the student will be able to:
- Differentiate the salient features between given types of electric drives (L4)
- Recommend the relevant motor for the given application with justification (L4)
- Estimate the relevant size and rating of electric motor for specific load cycles(L4)

Unit 2 Electric Heating & Welding **09**

Heating: Advantages of electric heating - Resistance heating - Design of heating element and problems- Induction heating and Dielectric heating.

Electric welding –comparison between electric and nonelectric welding- Resistance and Arc welding, gas welding, welding electrodes of various metals - Comparison between A.C. and D.C. Welding.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the procedure to maintain the given type of heating and welding system(L2)
- Recommend the relevant heating and welding system for given application with justification(L2)
- Design heating element of given type of furnace for specified data(L6)
- Describe with neat sketches construction of specified electric furnace(L2)

Unit 3 Illumination **14**

Introduction - terms used in illumination - Laws of Illumination - Sources of light – calculation of MHCP and MSCP- Construction and working of Incandescent Lamp, Fluorescent lamp, Sodium vapor lamp and LED and its applications- Solved problems.

Properties of good lighting – Basic principles of light control - Street lighting and Flood lighting.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain with sketches the working of given type of lamps(L2)
- Select relevant lamp for specified application with justification(L1)
- Describe the sketches construction of given type of lamp fittings(L2)

Unit 4 Electric Traction **09**

System of electric traction and track electrification - Speed-time curves for different services – trapezoidal and

quadrilateral speed time curves, problems. Calculations of tractive effort – power - Mechanics of train movement-specific energy consumption-effect of varying acceleration and braking retardation –Electric braking methods-adhesive weight and Coefficient of adhesion, problems

Learning Outcomes: At the end of the unit, the student will be able to:

- Select suitable track electrification system for specified traction services (L1)
- Differentiate between the given types of traction services based on given criteria(L4)
- Determination of scheduled and average speed and distance covered for given traction services using approximate speed time curves(L4)
- Describe the procedure to maintain given electric traction system.(L2)

Unit 5 Electric Vehicles 07

Introduction to EVs –History of EVs -Working of EVs-Electrical Machines for EVs-Types of vehicle chargers-Benefits of electric vehicles.

HEV Fundamentals-History of HEV-Advantages and Disadvantages-HEV Configurations- Parallel and Series-Parallel HEVs.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the working of various types of Electric vehicles(L2)
- Explain the working of various types of Hybrid vehicles(L2)
- Differentiate the salient features between given types of electric and hybrid vehicles(L4)

Prescribed Text Books:

1. B.R. Gupta. Generation of Electrical Energy,7th edition, Eurasia publishing House (P) Ltd , New Delhi. 2017.
2. C.L. Wadhwa. Generation, Distribution utilization of Electrical Energy, 3rd edition, New Age International Pvt Ltd. 2015.
3. R.K. Rajput. Utilization of Electrical Power, 1st edition, Laxmi Publications (P) Ltd, New Delhi. 2006.
4. Chris Mi, M. Abdul Masrur. Hybrid Electric Vehicles. 2nd Edition, Wiley Publications, 2017.

Reference Books:

1. N.V. Suryanarayana. Utilization of Electrical Power including Electric drives and Electric traction 1st edition, New Age International (P) Limited Publishers. 1996.
2. J.B.Gupta, "Utilization of Electrical Power and Electric Traction", 10th Edition, S.K.Kataria & Sons, 2012

Web Resources:

1. https://nptel.ac.in/courses/108/105/108105060/
2. https://electrical4u.in/utilization-of-electrical-energy/

Course Outcomes: Blooms Level of Learning

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

1. Identify the drives for industrial application. L2
2. Identify the suitable heating and welding methods for industrial applications L2
3. Analyze the Illumination phenomena & various lighting schemes L4
4. Discuss about Electric Traction systems L2
5. Discuss the various configurations and power flow control in HEVs L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27HT.1	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20A27HT.2	3	-	-	-	-	3	3	-	-	-	-	-	3	-
20A27HT.3	3	3	3	-	-	3	3	-	1	-	-	-	3	-
20A27HT.4	3	3	-	-	-	3	3	-	-	-	-	-	3	-
20A27HT.5	-	3	-	-	-	3	3	-	3	-	-	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Power Quality
Category	PEC
Couse Code	20A27IT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- Power quality terminology, power quality issues, classification
- Different sources of power quality disturbances
- Harmonic distortion; Principles for controlling harmonics
- Power quality measuring equipment; Power quality monitoring standards
- Impact of distributed generation on power quality

Unit 1 Introduction to Power Quality 08

Power Quality- definition, terminology, issues, evaluation procedure, responsibilities of the suppliers and users of electric power, power quality standards, and CBEMA and ITI curves.

Learning Outcomes: At the end of the unit, the student will be able to:

- Analyze various power quality issues(L4)
- Explain the power quality performance curves(L2)

Unit 2 Power Quality Disturbances 10

General classes of power quality problems- Impulsive and oscillatory transients. Long duration voltage variations - over voltage, under voltage, sustained interruption. Short duration voltage variations-interruption, sag, swell and outage. Sources of sags and interruptions, estimating voltage sag performance overview of mitigation methods.

Learning Outcomes: At the end of the unit, the student will be able to:

- Analyze various power quality disturbances(L4)
- Analyze the sources of sags and interruptions(L4)

Unit 3 Fundamentals of Harmonics 10

Harmonic distortion, voltage versus current distortion, harmonics versus transients, power system quantities under non-sinusoidal conditions, harmonic indices. Harmonic sources from commercial and industrial loads. Effects of harmonic distortion. Applied harmonics - harmonic distortion evaluation, principles of controlling harmonics, and devices for controlling harmonic distortion. Harmonic filter design and standards on harmonics.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the harmonic distortion and harmonic indices(L2)
- Explain the principle of controlling harmonics and devices for controlling harmonic distortion (L2)

Unit 4 Power Quality Monitoring 9

Power quality benchmarking, monitoring considerations, choosing monitoring locations, permanent power quality monitoring equipment, historical perspective of power quality measuring instruments. Power quality measurement equipment-types of instruments, assessment of power quality measurement data, power quality monitoring standards.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain about the power quality benchmarking(L2)
- Explain the various types of power quality measurement equipment(L2)
- describe power quality monitoring standards (L2)

Unit 5 Distributed Generation and Grid Interconnection 10

Distributed generation -connection requirements and impacts on the network. Interaction and optimal location of DG-Eigen analysis and voltage interaction. Power quality in DG-Mitigation of voltage dip during motor start, harmonic effects with DG, voltage flicker and fluctuation. Islanding issues, distribution line compensation-heavy Load and Light load condition, real generation, protection issues for distributed generation, technologies for distributed generation, power quality impact from different DG types.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe interaction and optimal location of distributed generation (L2)
- Explain the power quality impact from different distributed generation types (L2)

Prescribed Text Books:

1. Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, 3rd edition, TMH Education Pvt. Ltd., 2012.
2. Arindam Ghosh, Gerard Ledwich, Power quality enhancement using custom power devices, Kluwer academic publishers, 2002

Reference Books:

1. G.T. Heydt, Electric Power Quality, Stars in a circle Publications, 2nd edition 1991. USA.
2. Surajit Chattopadhyaya, Madhuchhanda Mitra, Samarjit Senugupta, Electrical Power Quality, Springer Dordrecht Heidelberg London New York.2011
3. Math H. J. Bollen, Understanding Power quality problems, IEEE Press, 2007.

Web Resources:

1. https://nptel.ac.in/courses/108/107/108107157/
2. https://nptel.ac.in/courses/108/106/108106025/

Course Outcomes: Blooms Level of Learning

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

1. Demonstrate knowledge on sources of power quality disturbances and issues, power quality monitoring and measuring instruments, power quality standards, effect of distributed generation on power quality. L1
2. Analyze various power quality issues. L3
3. Design a suitable harmonic filter for commercial and industrial loads. L4
4. Investigate various power quality issues and provide feasible solutions for improvement of power quality. L5
5. Select and use an appropriate equipment for monitoring and measurement of power quality. L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27IT.1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
20A27IT.2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20A27IT.3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20A27IT.4	2	2	-	-	2	-	-	-	-	-	-	-	-	2
20A27IT.5	3	3	-	-	3	-	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Special Electrical Machines
Category	PEC
Couse Code	20A27JT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To describe the construction, operation and performance of Special Electrical Machines.

Unit 1 Synchronous Reluctance Motors **10**

Constructional features of Synchronous Reluctance motor - Types - Axial and radial air gap motors - Operating principle - Reluctance - Phasor diagram – Characteristics - Vernier motor.

Learning Outcomes: At the end of the unit, the student will be able to:

- Demonstrate the constructional, operation and types of Synchronous Reluctance motor(L3)
- Analyze the performance of Synchronous Reluctance motor(L4)
- Describe the operation of Vernier motor.(L2)

Unit 2 Switched Reluctance Motors **10**

Constructional features of Switched Reluctance motor - Principle of operation - Torque prediction - Power controllers - Non-linear analysis - Microprocessor based control - Characteristics - Computer control.

Learning Outcomes: At the end of the unit, the student will be able to:

- Demonstrate the constructional, operation of Switched Reluctance motor(L3)
- Analyze the performance of Switched Reluctance motor(L4)

Unit 3 Stepper Motors **10**

Constructional features - Principle of operation -Variable reluctance motor - Hybrid motor - Single and multi-stack configurations - Theory of torque predictions - Linear and non-linear analysis - Characteristics - Drive circuits.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the constructional, operation of various stepper motors(L2)
- Analyze the performance of various stepper motors(L4)

Unit 4 Permanent Magnet BLDC Motors (PMBLDC) **10**

Constructional features - principle of operation of PMBLDC - Types - Magnetic circuit analysis - EMF and torque equations - Power controllers - Motor characteristics and control.

Learning Outcomes: At the end of the unit, the student will be able to:

- Demonstrate the constructional, operation and types of PMBLDC(L3)
- Analyze the performance of PMBLDC(L4)

Unit 5 Permanent Magnet Synchronous Motors (PMSM) **10**

Constructional features - principle of operation of PMSM - EMF and torque equations - Reactance - Phasor diagram - Power controllers - Converter - Volt-ampere requirements - Torque speed characteristics - Microprocessor based control.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the constructional, operation of PMSM(L2)
- Analyze the performance of PMSM(L4)

Prescribed Text Books:

1. T.J.E. Miller. Brushless Permanent Magnet and Reluctance Motor Drives. Clarendon Press, Oxford, 1989.
2. P.P.Aearnley. Stepping Motors – A Guide to Motor Theory and Practice. Peter Perengrinus. London, 2002.

Reference Books:

1. M.G.Say & E.O.Taylor, DC Machines, 2ndEdition, EBLS.
2. T. Kenjo. Stepping Motors and Their Microprocessor Controls. Clarendon Press London, 1990.
3. T. Kenjo and S. Nagamori, Permanent Magnet and Brushless DC Motors, Clarendon Press, London, 1990.

Web Resources:

1. https://www.mdpi.com/2071-1050/13/2/729/pdf
2. https://www.ti.com/lit/pdf/slvaen9
3. https://www.monolithicpower.com/en/stepper-motors-basics-types-uses
4. https://www.renesas.com/us/en/support/engineer-school/brushless-dc-motor-01-overview
5. https://www.embitel.com/blog/embedded-blog/brushless-dc-motor-vs-pmsm-how-these-motors-and-motor-control-solutions-work

Course Outcomes: Blooms Level of Learning

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

1. Describe the construction, operation and to sketch the characteristics of Syn. Rel. motors. — L2 & L3
2. Describe the construction, operation and to sketch the characteristics of Sw. Rel. motors. — L2 & L3
3. Describe the construction, operation and to sketch the characteristics of Stepper motors. — L2 & L3
4. Describe the construction, operation and to sketch the characteristics of PMBLDC motors. — L2 & L3
5. Describe the construction, operation and to sketch the characteristics of PMSM motors. — L2 & L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27JT.1	3	3	2	2	2	3	-	-	-	-	-	-	3	3
20A27JT.2	3	3	2	2	2	3	-	-	-	-	-	-	3	3
20A27JT.3	3	3	-	-	-	3	-	-	-	-	-	-	3	3
20A27JT.4	3	3	-	-	-	3	-	-	-	-	-	-	3	-
20A27JT.5	3	3	-	-	-	3	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Introduction to Artificial Intelligence and Soft Computing
Category	PEC
Couse Code	20A27KT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To explain the basics of Fuzzy logic
- To discuss the fundamentals of Genetic Algorithm
- To explain the basics of Neural network
- Conceptualize the basic ideas and techniques of AI
- To describe knowledge representation and planning.

Unit 1 Fuzzy logic **10**

Introduction to Fuzzy Set: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, membership functions, Fuzzy Logic: Fuzzy Logic basics, Fuzzy Rules and Fuzzy Reasoning, Fuzzy inference systems: Fuzzification of input variables, defuzzification and, fuzzy controllers.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe fuzzy sets, fuzzy relations, and membership functions(L2)
- Write fuzzy rules and design fuzzy controller(L1)

Unit 2 Genetic Algorithms **10**

Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, Solving single-objective optimization problems using GAs.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe about Genetic algorithm and its operators(L2)
- Apply Genetic algorithm for solving optimization problems(L3)

Unit 3 Artificial Neural Networks **10**

Introduction – Fundamental concept– Basic Models of Artificial Neural, Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron, Neural Network Architecture: Perceptron, Single layer Feed Forward ANN, Multilayer Feed Forward ANN, Activation functions, Supervised Learning: Delta learning rule, Back Propagation algorithm, Un-Supervised Learning algorithm: Self Organizing Maps

Learning Outcomes: At the end of the unit, the student will be able to:

- State neural network and recognize different neural network architecture(L1)
- Describe supervised and Unsupervised learning(L2)

Unit 4 Introduction to AI, Intelligent Agents and Problem solving **10**

Introduction and Definition of Artificial Intelligence, Intelligent Agents: Agents and Environments, Rationality, Nature of Environment, Structure of Agent, types of Agent, Problem Solving Agent, Formulating Problems,

Learning Outcomes: At the end of the unit, the student will be able to:

- Define Artificial intelligence (L1)
- Describe intelligent agents and its types(L2)

Unit 5 Knowledge, Reasoning and Planning: **10**

Knowledge based agents, First order logic: syntax and Semantic, Knowledge Engineering in FOL, Planning Agent,

Types of Planning: Partial Order, Hierarchical Order, Conditional Order

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe Knowledge based agents and first order logic(L2)
- State different types of planning(L1)

Prescribed Text Books:

1. Samir Roy and Chakraborty, —Introduction to soft computingll, Pearson Edition.
2. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.
3. S.Rajasekaran and G.A.Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and Genetic Algorithms" PHI Learning
4. N.P.Padhy,—Artificial Intelligence and Intelligent Systemsll, Oxford University Press.
5. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice- Hall, 2010.

Reference Books:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill Publications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.
3. Satish Kumar "Neural Networks A Classroom Approach" Tata McGraw-Hill.
4. Zimmermann H.S "Fuzzy Set Theory and its Applications "Kluwer Academic Publishers.

Web Resources:

1. https://nptel.ac.in/courses/106/102/106102220/
2. https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

Course Outcomes: Blooms Level of Learning

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

1. Design fuzzy controller system. L6
2. Apply Genetic algorithm for solving optimization problems L3
3. Construct supervised and unsupervised ANN for real world applications. L6
4. Choose an appropriate problem-solving method for an agent to find a sequence of actions to reach the goal state. L3
5. Analyze the strength and weakness of AI approaches to knowledge representation, reasoning and planning. L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27KT.1	3	3	3	3	-	-	-	-	-	-	-	3	3	-
20A27KT.2	3	3	3	3	-	1	-	-	-	-	-	3	3	-
20A27KT.3	3	3	-	3	2	-	-	-	-	-	-	3	3	-
20A27KT.4	3	3	-	3		-	-	1	-	-	-	3	3	-
20A27KT.5	3	3	3	3	2	-	-	-	-	-	-	3	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Energy Storage Systems
Category	PEC
Couse Code	20A27LT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To explore the fundamentals, technologies and applications of energy storage

Unit 1 Electrical Energy Storage Technologies 10

Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the roles of EES.(L4)
- Explain the necessity of continuous and flexible supply. (L2)

Unit 2 Energy Storage Technologies 10

Storage Types - Components of a Battery Energy Storage Systems (BESS) - Energy Storage System Components -Grid Connection for Utility-Scale BESS Projects -Battery Chemistry Types -Lead–Acid (PBA) Battery - Nickel–Cadmium (Ni–Cd) Battery-Lithium-Ion (Li-Ion) Battery.

Learning Outcomes: At the end of the unit, the student will be able to:
- Distinguish the various types of BESS.(L2)
- Classify the various types of batteries.(L1)

Unit 3 Features of Energy Storage Systems 09

Classification of EES systems, Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES), Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2), Synthetic natural gas (SNG).

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the electrochemical storage systems(L4)
- Explain the chemical energy storage systems and secondary batteries(L2)

Unit 4 Types of Electrical Energy Storage systems 10

Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES), Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

Learning Outcomes: At the end of the unit, the student will be able to:
- Analyze the superconducting magnetic energy storage systems.(L4)
- Discuss the thermal storage systems.(L2)

Unit 5 Applications 10

Present status of applications, Utility use (conventional power generation, grid operation & service) , Consumer use (uninterruptable power supply for large consumers), New trends in applications ,Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the Management and control hierarchy of storage systems(L2)

- List the various applications of energy storage systems(L1)

Prescribed Text Books:

1. Yongping Zhai. Handbook on Battery Energy Storage System Asian Development Bank.2018.
2. James M. Eyer, Joseph J.Iannucci and Garth P. Corey .Energy Storage Benefits and Market Analysis, Sandia National Laboratories, 2004.
3. Jim Eyer, Garth Corey", Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.
4. The Electrical Energy Storage by IEC Market Strategy Board.

Reference Books:

1. Doughty, D. H., and E. Peter Roth. 2012. A General Discussion of Li Ion Battery Safety. Electrochemical Society Interface 21 (2): 37–44. DOI: 10.1149/2.F03122if.
2. Electric Power Research Institute (EPRI). 2010. Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits. Palo Alto, California, US. http://large. stanford.edu/courses/2012/ph240/doshay1/docs/EPRI.pdf
3. Enel Green Power. 2016. Integrating Renewable Power Plants with Energy Storage.
4. Johnson, Jay, Benjamin Shenkman, Abraham Ellis, Jimmy Quiroz, and Carl Lenox. 2011. Initial Operating Experience of the La Ola 1.2-MW Photovoltaic System. Sandia National Laboratories Report SAND2011-8848. Kane, Mark. 2015. Bosch Cooperates with BMW And Vattenfall In Second Life Battery Project. Inside EVs 9 February.

Web Resources:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://swayam.gov.in/nd1_noc20_ee18/preview
3. https://www.coursera.org/learn/electric-vehicles-mobility?#syllabu

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze the significance of energy storage systems	L4
2. Classify the various types of energy storage systems	L2
3. Describe the real time applications of energy storage systems	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27KT.1	3	2	2	-	-	-	-	-	-	-	-	-	-	3
20A27KT.2	3	2	-	-	2	2	-	-	-	-	-	-	-	3
20A27KT.3	3	2	-	2	2	2	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Smart Grid
Category	OEC
Couse Code	20A27MT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

- To describe concept of smart grid and its advantages over conventional grid
- To discuss smart metering techniques and intelligent Electronic Devices
- To explain wide area measurement techniques
- To describe the problems associated with integration of distributed generation & its solution through smart grid.

Unit 1 Introduction to Smart Grid and Smart Meters 10

Introduction to Smart Grid, Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Concept of Robust & Self-Healing, smart Grid Present development & International policies in Smart Grid.
Introduction to Smart Meters, Smart Appliances, Automatic Meter Reading (AMR)Outage Management System (OMS)Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors.

Learning Outcomes: At the end of the unit, the student will be able to:

- Describe the Evolution and national policies of smart grid.(L2)
- Explain basics of smart appliances and hybrid vehicles.(L2)

Unit 2 Intelligent Electronic Devices (IED) 10

Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phasor Measurement Unit (PMU).

Learning Outcomes: At the end of the unit, the student will be able to:

- Analyze the protection of Intelligent Electronic Devices (IED)(L4)
- Explain wide area measurement techniques(L2)

Unit 3 Integration of Micro Grid with Alternative Solar Cells. 10

Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, Issues of interconnection, protection & control of micro-grid, Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines, Captive power plants, Integration of renewable energy sources.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the concept of micro-grid and its applications.(L2)
- Discuss the Integration of renewable energy sources.(L2)

Unit 4 Types of Electrical Energy Storage Systems 10

Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES), Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

Learning Outcomes: At the end of the unit, the student will be able to:

- Analyze the superconducting magnetic energy storage systems.(L4)
- Discuss the thermal storage systems(L2).

Unit 5 Communication Technologies in Smart Grid 10

Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide

Area Network (WAN), Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband over Power line (BPL), IP based protocols.

Learning Outcomes: At the end of the unit, the student will be able to:

- Learn the different communication technologies involved in Smart grid.(L1)
- Apply the modern technologies to smart grid solutions.(L3)

Prescribed Text Books:

1. Ali Keyhani, "Design Of Smart Power Grid Renewable Energy Systems", Wiley IEEE, 2011
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press, 2009.
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, "Smart Grid: Technology and Applications", Wiley 2012

Reference Books:

1. Stuart Borlase, "Smart Grid: Infrastructure, Technology and solutions "CRC Press
2. A.G.Phadke, "Synchronized Phasor Measurement and their Applications", Springer

Web Resources:

1. https://berc.co.in/images/pdf/meetings-workshop/Smart-Grid-Meters.pdf
2. https://www.researchgate.net/publication/305298788_Intelligent_Electronic_Devices_in_Smart_Grid_Applications
3. https://electrical-engineering-portal.com/ied-intelligent-electronic-device-advanced-functions
4. https://www.slideshare.net/Shahabkhan/microgrid-presentation
5. https://www.ripublication.com/irph/ijeee_spl/ijeeev7n10_05.pdf
6. https://www.slideshare.net/eeesrikanthkonda/smart-grid-communications

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Appreciate the difference between smart grid & conventional grid	L2
2. Apply smart metering concepts to industrial and commercial installations	L3
3. Formulate solutions in the areas of smart substations, distributed generation and wide area measurements	L3
4. Diagnose the power quality issues and auditing related to smart grid.	L4
5. Apply the modern technologies to smart grid solutions	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27MT.1	3	1	2	3	2	-	3	-	-	-	-	3	3	3
20A27MT.2	3	1	1	2	3	-	3	-	-	-	3	3	3	3
20A27MT.3	3	-	1	3	-	-	3	-	-	-	1	3	3	3
20A27MT.4	3	1	1	3	3	-	3	-	-	-	-	3	3	3
20A27MT.5	3	-	2	2	3	-	3	-	-	-	3	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	IoT Applications in Electrical Engineering
Category	OEC
Couse Code	20A27NT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- To describe the architecture of IoT.
- To discuss local and wide area networking
- To explain the design principle of IoT
- To discuss the hardware and technical design constraints.
- To describe advanced metering infrastructure and SCADA

Unit 1 M2M to IoT **10**

Introduction - Architecture of IoT - Challenges of IoT - M2M to IoT - IoT global context - Differing Characteristics - Deployment and Operational - IoT reference Model and architecture

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the Architecture of IoT(L2)
- Explain Challenges of IoT(L2)
- Describe IoT reference Model and architecture(L2)

Unit 2 IoT Fundamentals **9**

Devices and gateways - Local and wide area networking - Data management - Business processes in IoT - Everything as a Service (XaaS), M2M and IoT Analytics - Knowledge Management

Learning Outcomes: At the end of the unit, the student will be able to:

- Know the devices and gateways (L1)
- Explain business processes in IoT(L2)
- Describe the M2M and IoT Analytics. (L2)
- Describe the Knowledge Management(L2)

Unit 3 Design Principles **10**

An emerging industrial structure for IoT - The international driven global value chain - Global information monopolies – Building architecture - Design principles - Needed capabilities, Standards considerations

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the Global information monopolies(L2)
- Explain the building architecture(L2)
- Describe the Design principles(L2)

Unit 4 Design Constraints **12**

Technical Design constraints - Hardware Design constraints - Data representation and visualization - Interaction and remote control

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the Technical Design constraints(L2)
- Describe the Hardware Design constraints(L2)
- Discuss Interaction and remote control(L2)

Unit 5 Applications of IOT **9**

Advanced metering infrastructure (AMI)- SCADA (supervisory control and data acquisition)-Smart grid- remote control operation of energy consuming devices.

Learning Outcomes: At the end of the unit, the student will be able to:

- Explain the working of Advanced metering infrastructure (AMI) (L2)
- Describe the SCADA(L2)
- Discuss the remote-control operation of energy consuming devices(L2)

Prescribed Text Books:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, 1st edition, Cambridge University Press, 2021.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos and David Boyle, "From Machine -to - Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
3. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands - on - Approach), 1st Edition VPT, 2014.

Reference Books:

1. Arpan Pal, Balamuralidhar Purushothaman, IOT Technical Challenges and Solutions, 1st edition, Artech House Publishers, 2017.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013

Web Resources:

1. https://en.wikipedia.org/wiki/Internet_of_things
2. https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT
3. https://www.youtube.com/watch?v=LIhmzVL5bm8
4. https://www.iotforall.com/what-is-internet-of-things
5. https://nptel.ac.in/courses/106/105/106105166/

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Discuss the architecture, emerging industrial infrastructure and challenges involved in deployment of IoT	L2
2. Indicate the use of devices, gateways and hardware design constraints in IoT.	L1
3. Explain the industrial infrastructure for IoT and the design principles	L2
4. Describe the technical design constraints involved in IoT based industrial automation	L2
5. Outline the application of IoT in Electrical Engineering	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27NT.1	3	3	2	3	3	-	-	-	-	-	3	2	3	2
20A27NT.2	3	3	2	3	3	-	-	-	-	-	1	2	3	2
20A27NT.3	3	3	2	1	3	-	-	-	-	-	3	1	3	2
20A27NT.4	2	2	2	1	2	-	-	-	-	-	1	2	2	2
20A27NT.5	2	2	3	3	2	-	-	-	-	-	2	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Digital Signal Processing
Category	OEC
Couse Code	20A27OT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To apply discrete Fourier series and transforms
- To explain design techniques and applications of digital signal processing

Unit 1 **Introduction to Discrete Fourier Series and Discrete Fourier Transform:** **10**

Discrete time signals, LTI systems, stability and causality, Solution of linear constant coefficient difference equations, frequency domain representation of discrete time signals. Properties of discrete Fourier series, DFS representation of periodic sequences, discrete Fourier transforms: properties of DFT, linear convolution of sequences using DFT, computation of DFT

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the basics of Discrete time signals.(L2)
- Describe the concept of DFS and DFT and its properties(L2)
- Find N-Point DFT for a given signal/sequence.(L1)

Unit 2 **Fast Fourier Transforms:** **10**

Fast Fourier transforms (FFT)-Radix2 decimation in time and decimation in frequency FFT algorithms, inverse FFT and FFT for composite N.

Learning Outcomes: At the end of the unit, the student will be able to:
- Find N-Point DFT for a given signal/sequence using FFT algorithms.(L1)
- Find N-Point IDFT for a given signal/sequence using FFT algorithms.(L1)

Unit 3 **IIR Digital Filters** **10**

Analog filter approximations-Butterworth and Chebyshev, design of digital filters from analog filters. IIR Structures- Direct form –I , Direct form- II, Transposed Structure, Cascade form.

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain analog filters approximation(L2)
- Analyze different structures of IIR filters(L4)
- Design IIR filters using different techniques(L6)

Unit 4 **FIR Digital Filters** **10**

Characteristics of FIR digital filters, frequency response. Design of FIR digital filters using window techniques, frequency sampling technique and Fourier method, comparison of IIR and FIR filters.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe the concept of FIR filter (L2)
- Explain different structures of FIR filters(L2)
- Design FIR filter based on windowing methods(L6)
- Compare FIR and IIR filters.(L4)

Unit 5 **Applications of Digital Signal Processing** **10**

Spectral analysis of non-stationary signals, Musical Sound processing, signal Compression, Oversampling A/D

Converter, Oversampling D/A Converter.

Learning Outcomes: At the end of the unit, the student will be able to:

- Apply the knowledge and implement different applications of sampling rate conversion in multirate signal processing systems. (L3)
- Describe the applications of DSP to real-time requirements.(L2)

Prescribed Text Books:

1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th ed., 2007.
2. Digital Signal Processing, A computer base approach- Sanjit K Mitra, Tata McGraw, 4th ed., 2012

Reference Books:

1. Digital signal processing: Andreas Antoniou, TATA McGraw Hill, 2006.
2. Discrete Time Signal Processing-A.V. Oppenheim and R.W. Schaffer, 2nd ed., PHI.
3. Digital Signal Processing- P. Ramesh Babu, 4th Ed. SciTech Publications.
4. SenM.Kuo, Woonsen S. Gan, "Digital Signal Processors, Architecture, Implementations

Web Resources:

1. https://nptel.ac.in/courses/117/102/117102060/
2. https://nptel.ac.in/courses/108/101/108101174/
3. https://onlinecourses.nptel.ac.in/noc21_ee20/preview

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Explain the types of discrete time signals & systems and analyze using Fourier series and Fourier transforms.	L2
2. Analyze Fast Fourier transforms.	L4
3. Design IIR filters	L5
4. Design FIR filters	L5
5. Explain the applications of digital signal processing	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27OT.1	3	3	3	-	-	-	-	-	-	3	3	-	3	3
20A27OT.2	1	1	1	-	-	-	-	-	-	1	1	-	1	1
20A27OT.3	3	3	-	3	-	-	-	-	-	3	3	-	3	3
20A27OT.4	3	3	-	3	-	-	-	-	-	3	3	-	3	3
20A27OT.5	3	3	3	-	-	-	-	-	-	3	3	-	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	System Modelling and Simulation
Category	OEC
Couse Code	20A27PT
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
- To understand the basic system concepts and definitions of system.
- Techniques to model and to simulate various systems
- To analyze a system and to make use of the information to improve the performance

Unit 1 Introduction to Simulation Models 08

Basic Simulation Modeling, Systems, Advantages and disadvantages of simulation, Models and Simulation, Discrete Event Simulation, Simulation of Single Server Queuing System, Simulation of Inventory System, Alternative approach to Modeling and Simulation

Learning Outcomes: At the end of the unit, the student will be able to:
- Explain the simulation models.(L2)
- Discuss the queuing system.(L2)
- Describe the simulation inventory system.(L2)

Unit 2 Simulation Software 10

Comparison of Simulation Packages with Programming Languages, Classification of Software, Desirable Software Features, General Purpose Simulation Packages – Arena, Extend and Others, Object Oriented Simulation, Examples of Application Oriented Simulation Packages

Learning Outcomes: At the end of the unit, the student will be able to:
- Discuss the general-purpose software. .(L2)
- Explain the object-oriented simulation packages .(L2)

Unit 3 Building Simulation Models and Time Driven Simulation Models 12

Guidelines for Determining Levels of Model Detail, Techniques for Increasing Model Validity and Credibility, Modeling Time Driven Systems: Modeling Input Signals, Delays, System Integration, Linear Systems, Motion Control Models, Numerical Experimentation.

Learning Outcomes: At the end of the unit, the student will be able to:
- Describe simulation models.(L2)
- Discuss the modelling of time driven system.(L2)

Unit 4 Exogenous Signals, Events and Markov Process 12

Disturbance Signals, State Machines, Petri Nets & Analysis, System Encapsulation,
Markov Process: Probabilistic Systems, Discrete Time Markov Processes, Random Walks, Poisson Processes, the Exponential Distribution, Simulating a Poison Process, Continuous-Time Markov Processes

Learning Outcomes: At the end of the unit, the student will be able to:
- Discuss the Petri nets.(L2)
- Discuss the Markov process.(L2)
- Explain the continuous time Markov process .(L2)

Unit 5 Event Driven Models and System Optimization 10

Simulation Diagrams, Queuing Theory, characteristics of queuing system, Simulating Queuing Systems, Types of Queues, Multiple Servers, System Identification, Searches, Multidimensional Optimization, Modeling and Simulation Mythology

Learning Outcomes: At the end of the unit, the student will be able to:

- Discuss the simulation diagrams .(L2)
- Explain the simulation queuing systems & characteristics. .(L2)
- Describe the simulation methodology.(L2)
- Discuss the Multidimensional Optimization(L2)

Prescribed Text Books:

1. System Modeling & Simulation, an Introduction – Frank L. Severance, John Wiley & Sons, reprint, 2009.
2. Simulation Modeling and Analysis – Averill M. Law, W. David Kelton, TMH, 3rdEdition, 2003

Reference Books:

1. Systems Simulation – Geoffrey Gordon, PHI, 1978

Web Resources:

1. https://www.tutorialspoint.com/modelling_and_simulation/index.htm
2. https://www.youtube.com/watch?v=Wp3jyLkfBQs
3. https://web.stanford.edu/class/archive/ee/ee392m/ee392m.1056/Lecture9_ModelSim.pdf
4. https://www.youtube.com/watch?v=-gYcZt5iKPA
5. https://www.ddegjust.ac.in/studymaterial/mca-5/mca-504.pdf

Course Outcomes: Blooms Level of Learning

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

1. Describe basic concepts in Modeling and Simulation L2
2. Discuss the simulation software packages L2
3. Explain the time driven simulation models L2
4. Analyze exogenous and Markov process L4
5. Analyze queuing system and multidimensional optimization L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A27PT.1	3	3	2	2	3	-	-	-	-	-	3	2	3	2
20A27PT.2	3	3	2	1	1	-	-	-	-	-	1	2	3	2
20A27PT.3	3	3	1	2	3	-	-	-	-	-	2	1	3	2
20A27PT.4	2	2	2	1	1	-	-	-	-	-	2	1	2	2
20A27PT.5	2	2	2	3	2	-	-	-	-	-	2	3	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Universal Human Values - II
Category	HSMC
Couse Code	20AC71T
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

Unit 1 Course Introduction - Need, Basic Guidelines, Content and Process for Value Education **06**

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process;
- 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit 2 Understanding Harmony in the Human Being - Harmony in Myself! **6**

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body
- Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with disease.

Unit 3 Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship **6**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education, etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Unit 4 Understanding Harmony in the Nature and Existence -Whole existence as Coexistence **6**

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all pervasive space
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc.

Unit 5 Implications of the above Holistic Understanding of Harmony on Professional Ethics **6**

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a). Ability to utilize the professional competence for augmenting universal human order b). Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c). Ability to identify and develop appropriate technologies and management patterns for the above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a). At the level of individual: as socially and ecologically responsible engineers, technologists and managers b). At the level of society: as mutually enriching institutions and organizations
- Summing up.

Include practice Exercises and Case Studies (tutorial) Sessions e.g., to discuss the conduct of an engineer or a scientist, etc.

Prescribed Text Books:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar Kantak, 1999.
2. N. Tripathi, Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi. The Story of My Experiments with Truth
5. E. FSchumacher. Small is Beautiful
6. Cecile Andrews, Slow is Beautiful
7. J C Kumarappa. Economy of Permanence
8. Pandit Sunderlal. Bharat Mein Angreji Raj
9. Dharampal, Rediscovering India.
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. Maulana Abdul Kalam Azad. India Wins Freedom
12. Romain Rolland. Vivekananda (English)
13. Romain Rolland. Gandhi (English)
14. Jawaharlal Nehru. Rediscovery of India

Course Outcomes: Blooms Level of Learning

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

1. become more aware of themselves, and their surroundings (family, society, nature) — L2
2. Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. — L2
3. Have better critical ability. — L3
4. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society). — L3
5. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. — L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AC71T.1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20AC71T.2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20AC71T.3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20AC71T.4	-	-	-	-	-	-	-	-	-	-	-	3	-	-
20AC71T.5	-	-	-	-	-	-	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course	Internet of Things using Arduino & Node MCU
Category	SC
Couse Code	20A271L
Year	IV
Semester	I
Branch	EEE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
1	-	2	2

Course Objectives:
- To impart knowledge on Hardware Architecture of Arduino & Node MCU
- To impart knowledge on Programming Tools of Arduino
- To impart knowledge on Internet of Things

Unit-1 Introduction to Arduino T:3, P:6

Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, familiarizing with Arduino Interfacing Board, few examples where a Microcontroller is used, Installation of Arduino IDE windows OS, Run the Arduino executable file.

Learning Outcomes: At the end of the unit, the student will be able to:
- Learn the Hardware Architecture of Arduino (L1)
- Learn the Arduino programming language and IDE(L1)

Unit-2 Interfacing of LED, LCD and Push button T:3, P:6

Default program environment, Arduino Libraries, Serial Communications.

Project 1: write an Arduino program to blink an LED, Arduino program is saved as Sketch. Write a program to blink tricolor LED.

Project 2: Connect an LCD to Arduino board, Installation of LCD Library. write a program to display a text message on the LCD.

Project 3: Connect an LCD and a Push button to Arduino board, write a program to increase count on LCD when push button was pressed.

Learning Outcomes: At the end of the unit, the student will be able to:
- Understand the Default program environment of Arduino(L2)
- Lear how to Interfacing of LED, LCD and Push button to Arduino (L1)

Unit-3 Interfacing of seven segment display, DC Motor, Temperature & Humidity T:3, P:6

Project 4: Types of seven segment display, Interface a seven-segment display to Arduino board, Installation of LCD Library. Write a Program to display digits 0 to 9 in seven segment display.

Project 5: Pulse Width Modulation, duty cycle and frequency, Formula to calculate the duty cycle. Experiment to control the brightness of LED by varying the duty cycle, Experiment to control the speed and direction of a DC motor. Circuit connection explanation of the above experiments

Project 6: Circuit connection details of DHT11 sensor and Arduino, Installation DHT11 Arduino library, write a Code to detect the temperature and humidity using DHT11 sensor and display the output in the Serial Monitor screen.

Learning Outcomes: At the end of the unit, the student will be able to:
- Learn the concepts of seven segment display (L1)
- Learn interfacing of DC Motor, Temperature & Humidity sensors to Arduino(L1)

Unit-4 Introduction to IoT and Thingspeak T:3, P:6

Working of IoT, IoT system components, About Thingspeak platform, create an account in Thingspeak, Generate

the API keys, Importance of Write API key and Read API key. About MQTT Protocol.
Project 7: Various pins of ESP8266-01 Wi-Fi module Circuit connection of ESP8266 - 01 module with Arduino install ESP8266 Wi-Fi of Library, Establish a connection between Wi-Fi module.
Project 8: Circuit connection of DHT11 and Wi-Fi module with Arduino, write a program to upload temperature and humidity values from the DHT11 sensor in Thing Speak platform. Data Import/Export option to download the data as CSV file

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the concepts of Internet of Things & Thingspeak cloud(L2)
- Understand interfacing of ESP8266-01 Wi-Fi module with Arduino(L2)

Unit-5 Introduction to Node MCU, Blynk cloud and Arduino IoT Cloud T:3, P:6

Introduction to Node MCU, Pin configuration and architecture, Concept of digital and analog ports, few examples where a Microcontroller is used. create an account in Blynk cloud. create an account in Arduino IoT Cloud.
Project 9: Circuit connection of DHT11 with Node MCU, write a program to upload temperature and humidity values from the DHT11 sensor in Blynk cloud.
Project 10: Circuit connection of DHT11 with Node MCU, write a program to upload temperature and humidity values from the DHT11 sensor in Arduino IoT cloud.

Learning Outcomes: At the end of the unit, the student will be able to:

- Understand the concepts of Node MCU, Blynk cloud and Arduino IoT cloud(L2)
- Learn how to access the data using Blynk and Arduino cloud (L1)

Prescribed Text Books:

1. https://spoken-tutorial.org
2. Massimo Banzi, Getting Started with Arduino, Second Edition
3. Manoj R. Thakur, NodeMCU ESP8266 Communication Methods and Protocols

Reference Books:

1. https://www.arduino.cc/
2. https://thingspeak.com/
3. https://blynk.io/
4. Sooriyan, Nithukanth - Arduino Exodus Beginner Arduino Projects_ ESP8266 Arduino IDE Guide Basic Arduino Coding (2021)
5. Michael Margolis - Arduino Cookbook (Oreilly Cookbooks) (2011, OReilly Media)
6. Boxall, John - Arduino Workshop_ a Project-based Introduction (2013, Oreilly & Associates Inc)
7. Michael McRoberts (auth.) - Beginning Arduino (2013, Apress)

Web Resources:

1. https://nptel.ac.in/courses/106/105/106105166/
2. https://www.coursera.org/specializations/iot

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Design hardware and software for specific application using Arduino	L5
2. Recognize various devices, sensors and applications	L1
3. Summarize general concepts of Internet of Things (IoT)	L2
4. Design hardware and software for specific application using Node MCU	L5
5. Create IoT solutions using sensors, actuators and Devices	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A271L.1	3	3	3	-	3	3	-	-	-	-	-	3	3	3
20A271L.2	3	3	3	-	3	-	-	-	-	-	-	3	3	3
20A271L.3	3	3	3	-	3	3	-	-	-	-	-	3	3	3
20A271L.4	3	3	3	3	3	3	-	-	-	-	-	3	3	3
20A271L.5	3	3	3	3	-	-	-	-	-	-	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Electrical and Electronics Engineering

Title of the Course Simulation Studies on Power Electronics and Renewable Energy
Category SC
Couse Code 20A272L

Year IV
Semester I
Branch EEE

Lecture Hours	Tutorial Hours	Practical	Credits
1	-	2	2

Course Objectives: The students must be able to analyze the power electronic devices using MATLAB simulation.

- To analyze the power electronics converters with different topologies using MATLAB Simulink
- Study of PV modelling, effect of temperature variation and irradiation on a photovoltaic array.
- Simulate solar PV boost converter using P&O MPPT technique

Following topics are covered in Simulation studies on power electronics and renewable energy

1. Transfer function analysis of a given circuit using MATLAB.
2. Firing pulse generation schemes for single and three phase rectifiers with R and RL loads using MATLAB
3. Single - phase sinusoidal PWM inverter with R and RL loads using MATLAB.
4. Three - phase square wave inverter (180◦ conduction mode) with R and RL loads using MATLAB.
5. Boost-Buck DC-DC converter with R and RL loads using MATLAB.
6. Single Phase Cyclo-converter with R and RL Loads using MATLAB.
7. Modelling of PV cell
8. Effect of Temperature Variation on Photovoltaic Array
9. Effect of irradiation on a photovoltaic array
10. Design of solar PV boost converter using P&O MPPT technique.

Course Outcomes:

At the end of the course, the student will be able to	Blooms Level of Learning
1. Analyze AC/DC, DC/AC converters with different topologies using MATLAB Simulink.	L4
2. Analyze DC/DC &Cyclo-converter using MATLAB Simulink.	L4
3. Discuss PV modelling, effect of temperature and irradiation on PV array	L2
4. Analyze the simulation of solar PV boost converter with different technique	L4

Web Sources:

1. https://www.youtube.com/watch?v=O41BWhXFu8E
2. https://www.youtube.com/watch?v=HnEM8OISWNY
3. https://www.youtube.com/watch?v=Dg5AIy0bY1A
4. https://www.youtube.com/watch?v=zHbcAebjONU
5. https://www.youtube.com/watch?v=l4CfEB61fMc

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20A272L1	3	2	2	2	3	-	-	-	1	-	-	2	2	-
20A272L2	3	3	2	2	3	-	-	-	1	-	-	2	2	-
20A272L3	3	3	2	2	3	-	-	-	1	-	-	2	2	-
20A272L4	3	3	2	2	3	-	-	-	1	-	-	2	2	-