R22

ACADEMIC REGULATIONS, COURSE STRUCTURE, AND DETAILED SYLLABUS

ELECTRONICS AND COMMUNICATION ENGINEERING

Applicable to

B.Tech Regular Four Year Degree Programme

(For the Batches admitted from the Academic Year 2022-23)

B.Tech (Lateral Entry Scheme)

(For the Batches admitted from the Academic Year 2023-2024)

Offered under Choice Based Credit System (CBCS)

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

(UGC- AUTONOMOUS)

Sponsored by TKR Educational Society, Approved by AICTE, Affiliated to JNTUH
Accredited by NAAC with 'A' Grade. Accredited by NBA

(Medbowli, Meerpet, Balapur(M), Hyderabad, Telangana- 500097)

College

Vision:

Imparting Knowledge and instilling skills to the aspiring students in the field of Engineering, Technology, Science and Management to face the emerging challenges of the society.

Mission:

- Encouraging scholarly activities that transfer knowledge in the areas of Engineering, Technology, Science and Management.
- Ensuring students of all levels, well trained to meet the needs of education and their future endeavors.
- Inculcating human values and ethics into the education system for the all-round development of the students.

Department

About Department:

The Electronics and Communication Engineering Department was established in year 2005. The Department started with under graduate programmes in Electronics and Communication Engineering and later added Post Graduate programmes with specialization in VLSI system Design.It aims to deepen the knowledge and skills of the students on the basic concepts and theories that will equip them in their professional work involving analysis, systems implementation, operation, production, and maintenance of the various applications in the field of Electronics and Communications Engineering.The department has a blend of experienced and well qualified faculty having obtained Masters and Ph.D. degrees from premier institutes and have distinction of working with established national and international research organization.

Vision:

To be a centre of learning in the field of Electronics and Communication Engineering to develop competent professionals for industry and to fulfill the needs of the society.

Mission:

- To impart quality education through effective teaching learning process.
- To provide essential inter-disciplinary technology to make the students readily employable.
- To inculcate entrepreneurial skills to provide socially relevant and sustainable solutions.

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1.0 Under Graduate Degree Programme in Engineering & Technology (UGP in E&T)

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE (TKREC) offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice BasedCredit System (CBCS) in all branches of Engineering with effect from the Academic Year 2022-23

2.0. Eligibility for Admission

2.1. Admission to the undergraduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2. The medium of instructions for the entire undergraduate programme in Engineering & Technology will be **English** only.

3.0 B.TECH. PROGRAMME STRUCTURE

3.1. A student after securing admission shall complete the B.Tech. programme in a minimumperiod of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester,failing which student shall forfeit seat in B.Tech course. Each student shall secure 160 credits (with CGPA $\geq$ 5) required for the completion of the undergraduate programme and award of the B.Tech. Degree.

3.2. UGC/ AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1. Semester Scheme

Each undergraduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (≥ 90 instructional days) each and in each semester - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum /course structure suggested by AICTE are followed.

3.2.2 Credit Courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (Lecture periods: Tutorial periods: Practical periods: Credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for Theory/ Lecture (L) courses or Tutorials.
- One credit for two hours/ week/ semester for Laboratory/ Practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab are mandatory courses. These courses will not carry any credits.

3.2.3 Subject Course Classification

All subjects/ courses offered for the undergraduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The College

has followed almost all the guidelines issued by AICTE/UGC.

S. NO.	CATEGORY	Suggested breakup of credits (Total 160)
1	Humanities and Social sciences including Management	10*
2	Basic Sciences	22.5*
3	Engineering Sciences courses including Workshop, Drawing, basics of Electrical /Mechanical / Computer etc.	18.5*
4	Professional Core Courses	63*
5	Professional Elective Courses relevant to chosen specialization/branch	19*
6	Open Electives-Electives from other technical and/or emerging subjects	9*
7	Project work, Seminar and Internship in Industry or elsewhere	18*
8	Mandatory courses [Environmental Sciences, Induction Training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non- credit)
	Total	**160***

* Variation is allowed as per the need of the respective disciplines.

3.2.4. Subject Code Classification

The subject codes of various branches in TKREC Regulations are formulated using the following Procedure

Regulation, Branch, Semester, Classification, S. No.

Regulation	20, 21, 22, …., and so on
UG Branch	Corresponding branch code like CE,EE …..etc
Semester	01, 02, 03, 04, 05, 06, 07, 08
Classification	HS-Humanities and Sciences, BS-Basic Sciences, ES-Engineering Sciences, PC- Professional Core, PE- Professional Elective, OE-Open Elective, PW-Project Work
S. No.	01 to 09

4.0. COURSE REGISTRATION

4.1. A 'faculty advisor or counselor' shall be assigned to a group of 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

4.2. The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The on-line registration requests for any 'current semester' shall be **completed before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.

4.3. A student can apply for **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor / counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, Faculty Advisor / Counselor and the student.

4.4. A student may be permitted to register for all the subjects/ courses in a semester as specified in the course structure with maximum additional subject(s) / course(s) limited to 6 Credits (any 2 elective subjects), based on **progress** and SGPA/ CGPA, and completion of the '**pre-requisites'** as indicated for various subjects / courses, in the department course structure and syllabus contents.

4.5. Choice for '**additional subjects/ courses**', not more than any 2 elective subjects in any Semester, must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor / Mentor / HOD.

4.6. If the student submits ambiguous choices or multiple options or erroneous entries during **on-line** registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.

4.7. Subject / course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject(subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within **a week** after the commencement of class-work for that semester.

4.8. Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor 'within a period of 15 days' from the beginning of the current semester.

4.9**. Open Electives**: The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by his own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat / should not match with any category (Professional Core, Professional Electives, and Mandatory Courses etc.) of subjects even in the forthcoming semesters.

4.10**. Professional Electives**: The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

5.0. SUBJECTS / COURSES TO BE OFFERED

5.1. A subject/ course may be offered to the students, **only if** a minimum of 15 students opt for it.

5.2. More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

5.3. If more entries for registration of a subject come into picture, then the Head of the Department concerned shall decide, whether or not to offer such a subject / course for **two (or multiple) sections**.

5.4. In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the '**parent department**'.

6.0. ATTENDANCE REQUIREMENTS

6.1. A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (including attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab) for that semester. **Two periods** of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. **This attendance should alsobe included in the attendance submitted every fortnight to the College Examination Branch.**

6.2. Shortage of attendance in aggregate upto 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3. A stipulated fee shall be payable for condoning of shortage of attendance.

6.4. Shortage of attendance below 65% in aggregate shall in **NO** case be condoned.

6.5. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled, including all academic credentials (internal marks etc.) of that semester**. They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re-admission into that semester as and when offered; if 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 later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6. A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0. ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied, in addition to the attendancerequirements mentioned in Item No. **6**.

7.1. A student shall be deemed to have satisfied the academic requirements and earned the credits

allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40 marks including minimum 35% of average Mid-Term examinations for 25 marks) in the internal examinations, not less than 35% (21 marks out of 60 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.

7.2. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he (i) does not submit a report on Industry Oriented Mini Project / Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-time ResearchProject (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.

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

7.3. **Promotion Rules**

S. No.	Promotion	Conditions to be fulfilled
1	**First year first semester to firstyear second semester**	**Regular course of study of first year first semester.**
2	**First year second semester to Second year first semester**	**(i) Regular course of study of first yearsecond semester.** **(ii) Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whetherthe student takes those examinations or not.**
3.	**Second year first semester to Second year second semester**	**Regular course of study of second year first semester.**
4	**Second year second semester toThird year first semester**	**(i) Regular course of study of second year second semester.**

		(ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	**Third year first semester to Thirdyear second semester**	**Regular course of study of third year first semester.**
6	**Third year second semester to Fourth year first semester**	**(i) Regular course of study of third year second semester.** **(ii) Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second Semester from all the relevant regular and supplementary examinations,whether the student takes those examinations or not.**
7	**Fourth year first semester toFourth year second semester**	**Regular course of study of fourth year first semester.**

7.4. A student (i) shall register for all courses /subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA $\geq$ 5.0 (in each semester), and CGPA $\geq$ 5 (at the end of 8 semesters), (iv) **passes all the mandatory courses,** to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA **(at the end of undergraduate programme),** and shall be indicated in the grade card / marks memo of IV-year II semester.

7.5. If a student registers for **'extra subjects'** (in the parent department or other departments / branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be considered while calculating the SGPA and CGPA. For such '**extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card / marks memo as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations Items 6 and 7.1 – 7.4 above.

7.6. A student eligible to appear in the semester end examination for any subject/ course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappearfor that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.7. A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been re-admitted shall be applicable. Further, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which the student has been detained.

7.8. A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of academic credits.** The academic regulations under which the student has been readmitted shall be applicable to him.

8.0. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

8.1. The performance of a student in every subject / course (including practical and Project Stage – I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

8.2. In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of one part for 30 marks with a total duration of 2 hours as follows:

1. Midterm Examination in descriptive mode for 30 marks:

The remaining 10 marks of Continuous Internal Assessment (out of 40) are distributed as:

2. Assignment for 5 marks. (Average of 2 Assignments each for 5marks)
3. Subject Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the concerned subject for 5 marks.

The descriptive paper shall contain 5 full questions out of which, the student has to answer all the questions, each carrying 6 marks and internal choice may be given. Average of two mid-term examinations (I Mid-Term & II Mid-Term) will be taken as final marks for mid-term examinations (For 30 marks).

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

- The student, in each subject, shall have to earn 35% of marks(i.e.14 marks out of 40 marks) in CIE, 35% of marks (i.e.21 marks out of 60) in SEE and overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together to get pass grade (i.e. **C**) or above.
- The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 continuous Internal Examination (CIE) marks.
- In case, the student appears for Semester End Examination of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled in spite of appearing the SEE.

There is NO Computer Based Test (CBT) for R22 regulations.

8.2.1 The semester end examinations (SEE), for theory subjects, will be conducted for 60marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

The duration of Semester End Examination is 3 hours.

<u>The details of evaluation of end semester exam are as follows</u>

- Double evaluation of the answer scripts for the External Examinations is followed.
- The average of the two evaluations shall be considered as final marks.
- If the difference of two valuations is more than or equal to15 marks, third evaluation shall be recommended.
- If any difference appeared in the marks after the third valuation also, average of two evaluations will be considered whose difference is minimum, as final marks.

The details of challenging valuation of end semester exam are as follows

- There shall not be any recounting or re-evaluation for all subjects as the double valuation was adopted. But, the students will be given a chance to apply for challenging valuation for all the theory Subjects (no Practical/lab subjects) within one week from the date of declaration of results.
- Whenever the students apply for challenge valuation of answer scripts of semester end examinations, the students should submit their applications (through the HOD) within one week from the date of declaration of the results to the Examination Branch by paying Rs.10,000 (Rupees Ten Thousand only) per subject, in the form of Demand Draft, Drawn in Favor of "TKREC AUTONOMOUS". Any application received after the due date of submission for Challenge valuation, shall not be accepted under any circumstances.

On receipt of the DD

The answer script of the applied subject will be shown to the candidate to verify whether it belongs to him or not and the script will be evaluated by the senior faculty of the college appointed by the Controller of examinations. If there is any change in marks (Equal or above 15% of the maximum marks) the new marks will be awarded to the student. Otherwise, there will be no change in old marks. If the change in marks (Equal or above 15% of the maximum marks) occurs, an amount of Rs.9,000/- will be refunded to the student. Otherwise, the student will forfeit the total amount which he /she paid.

8.2.2. For the subject, Computer Aided Engineering Graphics, the Continuous Internal Evaluation(CIE) and Semester End Examinations (SEE) evaluation pattern is same as for other theory subjects.

8.3 For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components / procedure, expected outcome) which shall be evaluated for 10 marks.
2. **10 marks for viva-voce (**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before

semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the college.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

10 marks for write-up

15 marks for experiment/program

15 marks for evaluation of results

10 marks for presentation on another experiment / program in the same laboratory course and

10 marks for viva-voce on concerned laboratory course

❖ The student, in each subject, shall have to earn 35% of marks(i.e.14 marks out of 40 marks) in CIE, 35% of marks (i.e.21 marks out of 60) in SEE and overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together to secure Pass grade (i.e. "C") or above.

❖ The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 continuous Internal Examination (CIE) marks.

❖ In case, the student appears for Semester End Examination of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled in spite of appearing the SEE.

8.4 The evaluation of courses having ONLY internal marks in I-Year I Semester and II- Year II Semester is as follows:

1) I Year I Semester course (*ex., Elem ents of CE / ME / EEE / ECE / CSE*): The Continuous Internal Evaluation (CIE) is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e. 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) is absent as per schedule,or (ii) secures less than 40% marks in this course.

   For CSE / IT and allied branches the Continuous Internal Evaluation (CIE) will be for 50 marks. Each Mid-Term examination consists of two parts i) Part – A for 20 marks, ii) Part – B for 20 marks with a total duration of 2 hours.

Part A: Objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 20 marks.

Part B: Descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks.

The remaining 10 marks of Continuous Internal Evaluation are for Assignment (5 marks) and Subject Viva-Voce / PPT / Poster Presentation / Case Study (5 marks) and the evaluation pattern will remain same as for other theory subjects.

For all other branches, the Continuous Internal Evaluation (CIE) will be for 50 marks. Out of the 50 marks for internal evaluation:

a) A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks

b) 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.

c) Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 15 marks.

d) The remaining 15 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

2) II Year II Semester *Real-Time (or) Field-based Research Project* course: The Continuous Internal Evaluation (CIE) is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e. 20 marks out of 50 marks from average of the two examinations. There shall be NO externalevaluation. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (iii) secures less than 40% marks in this course..

8.5. There shall be Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation /semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project

shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a SeniorFaculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.

8.6. The UG project shall be initiated at the end of the IV Year I Semester and the durationof the project work is one semester. The student must present Project Stage – I during IV Year I Semester before II Mid examinations, in consultation with his Supervisor, the title, objective and plan of action of his Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start his project work.

8.7. UG project work shall be carried out in two stages: Project Stage – I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage – II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEE Theory examinations.

8.8. For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one re appearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.9. For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project / Internship / SDC etc. and the main Project shall be different fromthe topic already taken. The student is deemed to have failed, if he / she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum totalof the CIE and SEE taken together.

For conducting viva-voce of project, Controller and Principal selects an external examiner from the list of experts in the relevant branch submitted by the HOD concerned

A student, who has failed, may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one re appearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.10. A student shall be given one time chance to re-register for a maximum of two subjects in a semester

- If the internal marks secured by a candidate in the continuous Internal Evaluation marks for 40 (sum of average of two mid-term exams and two assignments & subject Viva-voce / PPT / Poster presentation / Case Study on the topic in concerned subject) are less than 35% and failed in those subjects.
- A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the class work in next academic year.

In the event of the student taking this chance, his Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled

9.0 GRADING PROCEDURE

9.1. Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory/ Practical's / Industry-Oriented Mini Project/Internship / SDC and Project Stage. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

9.2. As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B+ (Good)	7

50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	**Ab**	0

9.3. A student who has obtained an '**F**' grade in any subject shall be deemed to have '**failed**' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4. To a student who has not appeared for an examination in any subject, '**Ab**' grade will be allocated in that subject, and he is deemed to have '**Failed**'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remainthe same as those obtained earlier.

9.5. A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6. A student earns Grade Point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'Credit Points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit Points (CP) = Grade Point (GP) x Credits …. For a course

9.7. A student passes the subject/course only when GP $\geq$ **5 ('C' grade or above)**

9.8. The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points ($\sum$CP) secured from all subjects / courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimalplaces. SGPA is thus computed as

$$\mathbf{SGPA} = \{\sum_{i=1}^{n} \mathbf{Ci\ Gi}\} / \{\sum_{i=1}^{n} \mathbf{Ci}\} \ldots\ldots \mathbf{For\ each\ semester},$$

where 'i' is the subject indicator index (considering all subjects in a semester), 'N' is the no. of subjects '**registered**' for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

9.9. The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses (of 160) in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\mathbf{CGPA} = \{\sum_{j=1}^{m} \mathbf{Cj\ Gj}\} / \{\sum_{j=1}^{m} \mathbf{Cj}\} \text{ for all S Semesters Registered}$$

(i.e., up to and inclusive of S semesters, S ≥ 2),

where '**M**' is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered**' i.e., from the 1st semester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

SGPA = 152/21 = 7.24

Illustration of Calculation of CGPA up to 3rd Semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24

II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	69		Total Credit Points	518

CGPA = 518/69 = 7.51

The calculation process of CGPA illustrated above will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. programme.

9.10. For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.

9.11. SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0. PASSING STANDARDS

10.1. A student shall be declared successful or 'passed' in a semester, if he secures a GP ≥ 5 ('C' grade or above) in every subject/course in that semester (i.e. when the student gets an SGPA $\geq$ 5.0 at the end of that particular semester); and he shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.00 ('C' grade or above) for the award of the degree as required.

10.2. After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.) and credits

earned. **There is NO exemption of credits in any case.**

11.0. Declaration of results

11.1. Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

11.2. For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

$$\% \text{ of Marks} = (\text{final CGPA} - 0.5) \times 10$$

12.0. Award of Degree

12.1. A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA $\geq$ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified'** for the award of B.Tech. Degree in the branch of Engineering selected at the time of admission.

12.2. A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3. A student with final CGPA (at the end of the undergraduate programme) > 8.00, and fulfilling the following conditions - shall be placed in '**First Class with Distinction'**.
However, he

(i) Should have passed all the subjects/courses in '**First Appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA > 8 shall beplaced in **'First Class'.**

12.4. Students with final CGPA (at the end of the undergraduate programme) $\geq$ 7.0 but < 8.00 shall be placed in **'First Class'.**

12.5. Students with final CGPA (at the end of the undergraduate programme) $\geq$ 6.00 but < 7.00, shall be placed in '**Second Class'**.

12.6. All other students who qualify for the award of the degree (as per item 12.1), with finalCGPA (at the end of the undergraduate programme) $\geq$ 5.00 but < 6, shall be placed in '**pass class**'.

12.7. A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

12.8. Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**Gold Medal**'.

12.9. **Award of 2-Year B.Tech. Diploma Certificate**

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) up to B. Tech. – II Year – II Semester, if the student want to exit the 4-Year B. Tech. program. The student **once opted and awarded for 2-Year UG Diploma Certificate, the student will not be permitted to join** in B. Tech. III Year – I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree.

2. A student may be permitted to take one year break after completion of II Year – II Semester or B. Tech. – III Year – II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

13.0 WITHHOLDING OF RESULTS

13.1 If the student has not paid the fees to the College at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0. TRANSITORY REGULATIONS

A. For students detained due to shortage of attendance:

(1) A Student who has been detained in I year of R20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R22 Regulations and he is required to complete the study of B.Tech./B. Pharmacy programme within the stipulated period of eight academic years from the date of first admission in I Year.

(2) A student who has been detained in any semester of II, III and IV years of R20 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech./B. Pharmacy within the

stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

(i) A student of **R20** Regulations who has been detained due to lack of credits, shall be promoted to the next semester of **R22** Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both **R20 & R22** regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The **R22** Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in **R22** Regulations:

(i) A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.

(ii) The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R22 Regulations. **There is NO exemption of credits in any case**.

(iii) If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the University.

Note: If a student readmitted to R22 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the College Principals concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

15.0 STUDENT TRANSFERS

15.1. There shall be no branch transfers after the completion of admission process.

15.2. There shall be no transfers from one college/stream to another within the college.

15.3. The students seeking transfer to TKREC from various other Universities / institutions have to pass the failed subjects which are equivalent to the subjects of TKREC, and also pass the subjects of TKREC which the students have not studied at the earlier institution. Further, though the students

have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of TKREC, the students have to study those subjects in TKREC in spite of the fact that those subjects are repeated.

15.4 The transferred students from other Universities/Institutions to TKREC who are on rolls are to be provided one chance to write the CBT (for internal marks) in the **equivalent subject(s)** as per the clearance letter issued by the University.

15.5 The College will provide one chance to write the internal examinations in the equivalent subject(s) to the students transferred from other Universities/ institutions to TKREC who are on rolls, as per the clearance equivalence) letter issued by the University.

16.0 SCOPE

16.1. The academic regulations should be read as a whole, for the purpose of any interpretation.

16.2. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

16.3. The University may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the University authorities.

16.4. Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

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TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME) FROMTHE AY 2023-24

1. **Eligibility for the award of B.Tech Degree (LES)**

   The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech Programme (LES) for the award of B.Tech. degree.

3. The students, who fail to fulfill the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

5. **Promotion rule**

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 24 credits out of 40 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
7. LES students are not eligible for 2-Year B. Tech. Diploma Certificate.

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MALPRACTICES RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices /Improper conduct	Punishment
	If the candidate:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, notebook, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject to the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination).	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam Hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject to 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 the relevant material will be kept in the Examinations Branch.

3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all College 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 de barred for two consecutive semesters from class work and all **College** examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent/	In case of students of the college, they shall be expelled from

	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.	examination halls and cancellation of their performance in that subject and allot her subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any par there of 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 **College** examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also

		debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered Against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester / year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the **Controller/Principal** for further action to award suitable punishment.	

I Year B.Tech. ECE - I Sem							
S. No	**Subject Code**	**Category**	**Subject Name**	**Hours per**			**Credits**
				L	**T**	**P**	
1	22MA101BS	BS	Matrices and Calculus	3	1	0	4
2	22PH102BS	BS	Applied Physics	3	1	0	4
3	22EC103ES	ES	C Programming for Engineers	3	0	0	3
4	22ME104ES	ES	Engineering Workshop	0	1	3	2.5
5	22EN105HS	HS	English for Skill Enhancement	2	0	0	2
6	22EC106ES	ES	Elements of Electronics and Communication Engineering	0	0	2	1
7	22PH107BS	BS	Applied Physics Laboratory	0	0	3	1.5
8	22EC108ES	ES	C Programming for Engineers Laboratory	0	0	2	1
9	22EN109HS	HS	English Language and Communication Skills Laboratory	0	0	2	1
			Induction Programme				
TOTAL				**14**	**3**	**12**	**20**

I Year B.Tech. ECE - II Sem							
S. No	**Subject Code**	**Category**	**Subject Name**	**Hours per**			**Credits**
				L	**T**	**P**	
1	22MA201BS	BS	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2	22CH202BS	BS	Engineering Chemistry	3	1	0	4
3	22ME204ES	ES	Computer Aided Engineering Graphics	1	0	4	3
4	22EE204ES	ES	Basic Electrical Engineering	2	0	0	2
5	22EC205ES	ES	Electronic Devices and Circuits	2	0	0	2
6	22EC206ES	ES	Applied Python Programming Laboratory	0	1	2	2
7	22CH207BS	BS	Engineering Chemistry Laboratory	0	0	2	1
8	22EE208ES	ES	Basic Electrical Engineering Laboratory	0	0	2	1
9	22EC209ES	ES	Electronic Devices and Circuits Laboratory	0	0	2	1
TOTAL				**11**	**3**	**12**	**20**

II Year B.Tech. ECE - I Sem							
S. No	**Subject Code**	**Category**	**Subject Name**	**Hours per**			**Credits**
				L	**T**	**P**	
1	22MA301BS	BS	Numerical Methods and Complex Variables	3	1	0	4
2	22EC301PC	PC	Analog Circuits	3	0	0	3
3	22EC302PC	PC	Network analysis and Synthesis	3	0	0	3
4	22EC303PC	PC	Digital Logic Design	3	0	0	3
5	22EC304PC	PC	Signals and Systems	3	1	0	4
6	22EC305PC	PC	Analog Circuits Laboratory	0	0	2	1
7	22EC306PC	PC	Digital logic Design Laboratory	0	0	2	1
8	22EC307PC	PC	Basic Simulation Laboratory	0	0	2	1
9	22MC310	MC	Constitution of India	3	0	0	0
TOTAL				**18**	**2**	**6**	**20**

II Year B.Tech. ECE - II Sem							
S. No	**Subject Code**	**Category**	**Subject Name**	**Hours per**			**Credits**
				L	**T**	**P**	
1	22EC401PC	PC	Probability Theory and Stochastic Processes	3	0	0	3
2	22EC402PC	PC	Electromagnetic Fields and Transmission Lines	3	0	0	3
3	22EC403PC	PC	Analog and Digital Communications	3	0	0	3
4	22EC404PC	PC	Linear and Digital IC Applications	3	0	0	3
5	22EC405PC	PC	Electronic Circuit Analysis	3	0	0	3
6	22EC406PC	PC	Analog and Digital Communications Laboratory	0	0	2	1
7	22EC407PC	PC	Linear and Digital IC Applications Laboratory	0	0	2	1
8	22EC408PC	PC	Electronic Circuit Analysis Laboratory	0	0	2	1
9	22EC401PW	PW	Real Time Project/ Field Based Project	0	0	4	2
10	22MC409	MC	Gender Sensitization Lab	0	0	2	0
TOTAL				**15**	**0**	**12**	**20**

III Year B.Tech. ECE – I Sem							
S. No	**Subject Code**	**Category**	**Subject Name**	**Hours per**			**Credits**
				L	**T**	**P**	
1	22EC501PC	PC	Microprocessors and Microcontrollers	3	1	0	4
2	22EC502PC	PC	CMOS VLSI Design	3	0	0	3
3	22EC503PC	PC	Control Systems	3	1	0	4
4	22EC504PC	PC	Antennas and Wave Propagation	3	0	0	3
5			Professional Elective – I	3	0	0	3
6	22EC505PC	PC	Microprocessors and Microcontrollers Laboratory	0	0	2	1
7	22EC506PC	PC	CMOS VLSI Design Laboratory	0	0	2	1
8	22EC507PC	PC	Advanced Communications Laboratory	0	0	2	1
9	22MC510	MC	Intellectual Property Rights	3	0	0	0
TOTAL				**18**	**2**	**6**	**20**

Professional Elective – I			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC511PE	PE	Computer Organization and Operating Systems
2	22EC512PE	PE	Network Security and Cryptography
3	22EC513PE	PE	Electronic Measurements and Instrumentation

III Year B.Tech. ECE – II Sem							
S. No	**Subject Code**	**Category**	**Subject Name**	**Hours per**			**Credits**
				L	**T**	**P**	
1	22EC601PC	PC	Digital Signal Processing	3	0	0	3
2	22EC602PC	PC	IoT Architectures and Protocols	3	0	0	3
3	22HS601MS	MS	Business Economics and Financial Analysis	3	0	0	3
4			Professional Elective - II	3	0	0	3
5			Open Elective – I	3	0	0	3
6	22EC603PC	PC	Digital Signal Processing Laboratory	0	0	2	1
7	22EC604PC	PC	IoT Architectures and Protocols Laboratory	0	0	2	1
8	22EN601HS	HS	Advanced English Communication Skills Laboratory	0	0	2	1
9	22EC601PW	PW	Industry Oriented Mini Project/ Internship	0	0	4	2
10	22MC610	MC	Environmental Science	3	0	0	0
TOTAL				**18**	**0**	**10**	**20**

Professional Elective – II			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC621PE	PE	Data Communications and Computer Networks
2	22EC622PE	PE	Embedded System Design
3	22EC623PE	PE	Artificial Neural Networks

Open Elective – I			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC611OE	OE	Fundamentals of Internet of Things
2	22EC612OE	OE	Principles of Signal Processing
3	22EC613OE	OE	Digital Electronics for Engineering
4	22EC614OE	OE	Object Oriented Programming

IV Year B.Tech. ECE – I Sem							
S. No	**Subject Code**	**Category**	**Subject Name**	**Hours per**			**Credits**
				L	**T**	**P**	
1	22EC701PC	PC	Microwave Engineering	3	1	0	4
2			Professional Elective – III	3	0	0	3
3			Professional Elective – IV	3	0	0	3
4			Open Elective – II	3	0	0	3
5	22HS701MS	MS	Professional Practice, Law & Ethics	2	0	0	2
6	22EC702PC	PC	Microwave Engineering Laboratory	0	0	2	1
7	22EC703PC	PC	Scripting Languages Lab	0	0	2	1
8	22EC701PW	PW	Project Stage – I	0	0	6	3
TOTAL				**14**	**1**	**10**	**20**

Professional Elective – III			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC731PE	PE	Digital Image Processing
2	22EC732PE	PE	CMOS Analog IC Design
3	22EC733PE	PE	Coding Techniques

Professional Elective – IV			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC741PE	PE	Radar Systems
2	22EC742PE	PE	Satellite Communications
3	22EC743PE	PE	Biomedical Instrumentation

Open Elective – II			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC721OE	OE	Electronic Sensors
2	22EC722OE	OE	Electronics for Health Care
3	22EC723OE	OE	Telecommunications for Society

IV Year B.Tech. ECE – II Sem						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1		Professional Elective – V	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4	22EC801PW	Project Stage – II including Seminar	0	0	22	11
Total			**9**	**0**	**22**	**20**

Professional Elective – V			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC851PE	PE	5G and beyond Communications
2	22EC852PE	PE	Artificial Intelligence
3	22EC853PE	PE	Optical Communications

Professional Elective – VI			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC861PE	PE	Mobile Communications and Networks
2	22EC862PE	PE	Pattern Recognition & Machine learning
3	22EC863PE	PE	Wireless Sensor Networks

Open Elective – III			
S. No	**Subject Code**	**Category**	**Subject Name**
1	22EC831OE	OE	Measuring Instruments
2	22EC832OE	OE	Communication Technologies
3	22EC833OE	OE	Fundamentals of Social Networks

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I Year B.Tech. ECE- I Sem

L	T	P	C
3	1	0	4

(22MA101BS) MATRICES AND CALCULUS

Course out comes: Upon completing this course, the students will be able to

1 Write the matrix representation of a set of linear equation s and to analyze he solution of the system of equations

2 Find the Eigen values and Eigen vectors and reduce the quadratic form to canonical form using orthogonal transformations.

3 Apply the mean value theorems and evaluate the improper integrals using Beta and Gamma functions.

4 Find the extreme values of functions of two variables with / without constraints.

5 Evaluate the multiple integrals and apply the concept to find areas, volumes

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		1								1		
CO2	2	3												
CO3	2	2		1								1		
CO4	2	1			2							1		
CO5		1										1		

UNIT - I: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss Jordan method, System of linear equations-Consistency and Inconsistency of system of equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

UNIT - II: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigen values, Eigen vectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms using Orthogonal Transformation.

UNIT - III: Mean value theorems and Beta and Gamma Functions

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series (without proof). Beta and Gamma functions and their properties.

UNIT – IV: Multivariable Calculus (Partial Differentiation and applications)

Definitions of Limit and continuity, Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT – V: Multiple Integrals

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals. Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

TEXT BOOKS:

1 B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2016.

2 R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, NarosaPublications, 10th Edition, 2020.

REFERENCE BOOKS:

1 Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2018.

2 G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson, Reprint,2002

3 N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2018.

4 H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi

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I Year B.Tech. ECE- I Sem

L	T	P	C
3	1	0	4

(22PH102BS) APPLIED PHYSICS

Course out comes: Upon completing this course, the students will be able to

1 Gain knowledge on fundamentals of modern physics and quantum mechanics, and utilize the Knowledge in various applications.
2 Able to apply various electronic circuits by the fundamentals of semiconductor physic
3 Study the fundamental concepts related to the dielectric, magnetic materials and super conductors
4 Identify the importance of nano scale, quantum confinement and various fabrications
5 Able to apply the learned knowledge of LASER and Fibre optics in communication systems.

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3			1						2		
CO2	2	1			1							2		
CO3	2	1			1							1		
CO4	3			2	2							2		
CO5	2	1			1				1			1		

UNIT - I: QUANTUM PHYSICS AND SOLIDS

Quantum Mechanics: Introduction to quantum physics, blackbody radiation –Energy distribution of Black body, Planck's radiation law - photoelectric effect - Davisson and Germer experiment – Heisenberg uncertainty principle - Born interpretation of the wave function – time independent Schrodinger wave equation - particle in one dimensional potential box. Solids: free electron theory (Drude & Lorentz, Somerfield) - Fermi-Dirac distribution - Bloch's theorem -Kronig-Penney model – E-K diagram- effective mass of electron-origin of energy bands classification of solids

UNIT - II: SEMICONDUCTORS AND DEVICES

Intrinsic and extrinsic semiconductors – Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and characteristics of P-N Junction diode, Zener diode and bipolar junction transistor (BJT)–LED, PIN diode, avalanche photo diode (APD) and solar cell, their structure, materials, working principle and characteristics.

UNIT - III: DIELECTRIC, MAGNETIC AND SUPERCONDUCTORS

Dielectric Materials: Basic definitions- types of polarizations (qualitative) - ferroelectric, piezoelectric, and pyroelectric materials – applications – liquid crystal displays (LCD) and crystal Oscillators. Magnetic Materials: Hysteresis- soft and hard magnetic materials – magne to striction, Magneto resistance - applications - bubble memory devices, magnetic field sensors and multiferroics. Superconductivity: Introduction to super conductors (temperature dependence), Meissner effect, types of superconductors, characteristics of superconductors, Applications of superconductors

UNIT – IV: NANOTECHNOLOGY

Nanoscale, quantum confinement, surface to volume ratio, bottom-up fabrication: sol-gel, precipitation, combustion methods – top-down fabrication: ball milling - physical vapor deposition (PVD) - chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - Applications of nonmaterial's.

UNIT – V: LASER AND FIBER OPTICS

Lasers: Laser beam characteristics-three quantum processes-Einstein coefficients and their relations Lasing action - pumping methods- ruby laser, CO2 laser, Argon ion Laser, Nd: YAG laser semiconductor laser-applications of laser. Fiber Optics: Introduction to optical fiber- advantages of optical Fibers - total internal reflection construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers Losses in optical fiber - optical fiber for communication system - applications.

TEXT BOOKS:

1 M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" A Text book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.

2 Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019

3 Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4thEdition,2021.

4 B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2ndEdition,2022

5 Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021

REFERENCE BOOKS:

1 Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.:

2 Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition, 2018.

3 Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019

4 Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.

5 A.K. Bhandhopadhya - Nano Materials, New Age International, 1stEdition, 2007

6 Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group

7 Energy Materials, Taylor & Francis Group, 1st Edition, 2022.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- I Sem	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(22EC103ES) C PROGRAMMING FOR ENGINEERS

Course Objectives:

1 To learn the fundamentals of computers.
2 To understand the various steps in Program development
3 To learn the syntax and semantics of C Programming Language.
4 To learn the usage of structured programming approach in solving problems.

Course Outcomes: Upon completing this course, the students will be able to

1 Draw flowcharts for solving arithmetic and logical problems, understanding programming basics
2 Develop code using control and loops statements.
3 Formulate algorithms and programs using functions, arrays and strings
4 Utilize handle file I/O operations in C using pointers
5 Write a programs using Searching and sorting algorithms and programs using structures

Cos	**PROGRAMME OUTCOMES**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	-	-	-	-	-	1	2	2
CO2	3	2	3	2	-	2	-	-	-	-	-	1	2	2
CO3	3	3	2	1	-	2	-	1	-	-	-	1	2	3
CO4	3	3	3	2	-	1	-	1	-	-	-	1	2	3
CO5	3	3	3	2	-	1	-	1	-	-	-	1	2	3

UNIT- I

Introduction to Computer Algorithms and Programming Components of a computer system: Memory, processor, I/O devices, storage, operating system, the concept of assembler, compiler, interpreter, loader, and linker.

From algorithm to program: Representation of an algorithm, flowchart, Pseudo code with examples, converting algorithms to programs.

Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object, and executable code. Components of C language, standard I/O in C, data types, variables and constants, memory storage, and storage classes.

UNIT – II

Expressions and Statements Expressions and their evaluation: Operands and Operators, formation of expressions using arithmetic, relational, logical, and bitwise operators, precedence and associatively rules, mixed operands, type conversion, and evaluation of expressions. Statements: Simple and compound statements, Conditional Branching: if and switch statements, nested if-else, dangling else problem, use of break and default with switch. Iteration and loops: use of while, do-while and for loops, nested loops, use of break and continue statements

UNIT - III

Functions and Arrays Designing Structured Programs: Introduction to functions, advantages of modularizing a program into functions, types of functions, passing parameters to functions: call by

value; call by reference, passing arrays to functions, recursion with example programs. Arrays: Array notation and representation, manipulating array elements, using multidimensional arrays, character arrays, C strings, string input/output functions, Array of strings, string manipulation functions with example programs.

UNIT – IV

Pointers and File handling Pointers: Introduction, declaration, applications, dynamic memory allocation (malloc, calloc, realloc, free), use of pointers in self-referential structures. File handling: File I/O functions, standard C pre-processors, defining and calling macros, command-line arguments.

UNIT – V

Derived types And Basic Algorithms: Structures, Union, Enums and Bit-fields: Defining, declaring, and usage of structures, unions, and their arrays, passing structures, and unions to functions, introduction to enums and bit-fields.

Basic Algorithms: Searching and Sorting Algorithms (Bubble, Insertion, and Selection), finding roots of equations, notion of order of complexity through example programs.

TEXT BOOKS:

1 B. A. Forouzan and R. F. Gilberg -Programming & Data Structures, 3 rd Ed., Cengage Learning`

2 Byron Gottfried - Schaum's Outline of Programming with C, McGraw-Hill

REFERENCE BOOKS:

1 Ajay Mittal - Programming in C: A practical approach, Pearson Education, 2010

2 Kernighan Brian W. and Ritchie Dennis M.- The C programming, Pearson Education

3 J. R. Hanlyand, E. B. Koffman -Problem Solving and Program Design, 5 th Ed., Pearson Education.

4 H. Cheng - C for Engineers and Scientists, McGraw-Hill International Edition 5. V. Rajaraman - Computer Basics and C Programming, PHI Learning, 2015.

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I Year B.Tech. ECE- I Sem	**L**	**T**	**P**	**C**
	0	**1**	**3**	**2.5**

(22ME104ES) ENGINEERING WORKSHOP

Course Objectives:

1. To Study of different hand operated power tools, uses and their demonstration.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field
4. To develop a right attitude, team working, precision and safety at work place.
5. It explains the construction, function, use and application of different working tools, equipment and machines
6. To study commonly used carpentry joints
7. To have practical exposure to various welding and joining processes
8. Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances

Course Outcomes: Upon completing this course, the students will be able to

1 Demonstrate various machines, tools and their operations
2 Apply different workshop trades like fitting, carpentry, foundry and welding
3 Practice workshop trades like Tim smith, Black smithy.
4 Apply suitable tools for different trades of engineering processes including drilling,
5 Apply basic electrical engineering knowledge for house wiring practice.

Cos	**PROGRAMME OUTCOMES**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1						2	1		1		
CO2	2	2	1						2	1		1		
CO3	2	1	1						2	1		1		
CO4	2	1	1						2	1		1		
CO5	2	2	1						2	1		1		

1.TRADES FOR EXERCISES:

At least two exercises from each trade:

I Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
II Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
III Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
IV Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
V Welding Practice – (Arc Welding & Gas Welding)
VI House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
VII Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and Wood

Working

TEXT BOOKS:

1 Workshop Practice /B. L. Juneja / Cengage
2 Workshop Manual / K. Venugopal / Anuradha

REFERENCE BOOKS:

1 Work shop Manual - P. Kannaiah/ K.L. Narayana/ Scitech Workshop Manual / Venkat Reddy/ BSP

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I Year B.Tech. ECE- I Sem

L	T	P	C
2	0	0	2

(22EN105HS) ENGLISH FOR SKILL ENHANCEMENT

Course Outcomes: Upon completing this course, the students will be able to

1 Choose appropriate vocabulary and sentence structures for their oral and written communication.
2 Demonstrate their understanding of the rules of functional grammar.
3 Develop comprehension skills from the known and unknown passages
4 Take an active part in drafting paragraphs, letters, essays, abstracts, précis and reports in Various contexts.
5 Acquire basic proficiency in reading and writing modules of English.

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		3		
CO3						3			2	3		3		
CO4						2			3	3		2		
CO5						3			2	3		3		

UNIT- I

Chapter entitled 'Toasted English' by **R.K.Narayan** from "English: Language, Context and Culture" published by Orient Black Swan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives – Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT – II

Chapter entitled **'Appro JRD' by Sudha Murthy** from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs **Grammar:** Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT - III

Chapter entitled **'Lessons from Online Learning'** by **F.Haider Alvi, Deborah Hurst et al** from "English: Language, Context and Culture" published by Orient Black Swan, Hyderabad.
Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.
Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

UNIT – IV

Chapter entitled **'Art and Literature'** by **Abdul Kalam** from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad.
Vocabulary: Standard Abbreviations in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice
Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing

UNIT – V

Chapter entitled 'Go, Kiss the World' by **Subroto Bagchi** from "English: Language, Context And Culture" published by Orient BlackSwan, Hyderabad.
Vocabulary: Technical Vocabulary and their Usage
Grammar: Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
Reading: Reading Comprehension-Exercises for Practice Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

TEXT BOOKS:

1 "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

REFERENCE BOOKS:

1 Effective Academic Writing by Liss and Davis (OUP)
2 Richards, Jack C. (2022) Interchange Series. Introduction, 1,2,3. Cambridge University Press
3 Wood, F.T. (2007). Remedial English Grammar. Macmillan
4 Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd.
5 (2019). Technical Communication. Wiley India Pvt. Ltd.
6 Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.
7 Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- I Sem **L T P C**

0 0 2 1

(22EC106ES) ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Outcomes: Upon completing this course, the students will be able to

1 Identify the different components used for electronics applications.

2 Measure different parameters using various measuring instruments

3 Distinguish various signal used for analog and digital communications

4 Distinguish various signal generators and measuring instruments in the measurement. of various parameters.

5 Design simple circuits to measure the voltage and current with Voltmeter and Ammeter.

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1			1			1		
CO2	3	2	3	2	1	2			1			1		
CO3	3	3	2	1	1	2			1			1		
CO4	3	3	2	1	1	2			1			1		
CO5	3	2	3	2	1	2			1			1		

List of Experiments:

1 Understand the significance of Electronics and communications subjects

2 Identify the different passive and active components

3 Color code of resistors, finding the types and values of capacitors

4 Measure the voltage and current using voltmeter and ammeter

5 Measure the voltage, current with Multimeter and study the other measurements using Multimeter

6 Study the CRO and measure the frequency and phase of given signal

7 Draw the various Lissajous figures using CRO

8 Study the function generator for various signal generations

9 Study of Spectrum analyzer and measure the spectrum

10 Operate Regulated power supply for different supply voltages

11 Study the various gates module and write down the truth table of them

12 Identify various Digital and Analog ICs

13 Observe the various types of modulated signals.

14 Know the available Softwares for Electronics and communication applications

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I Year B.Tech. ECE- I Sem

L	T	P	C
0	0	3	1.5

(22PH107BS) APPLIED PHYSICS LABORATORY

Course Outcomes: Upon completing this course, the students will be able to

1 Able to study the (V-I/P-I) characteristics of LED,LASER and Solar cell

2 Able to understand the energy gap of semiconductor diode

3 Correlate the theory of Hall Effect with experiment by determining the Hall coefficient.

4 Examine the Bending losses for different Optical fiber cables

5 Able to understand various concepts-Resonance, Time constant and Magnetic field using LCR, RC, Stewart and Gees circuits.

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		1		2				2			2		
CO2	2		1		1				2			2		
CO3	2			1	2				1			2		
CO4	2		2		1							2		
CO5	2	2	2									2		

List of Experiments:

1 Determination of work function and Planck's constant using photoelectric effect

2 Determination of Hall co-efficient and carrier concentration of a given semiconductor

3 Characteristics of series and parallel LCR circuits

4 V-I characteristics of a p-n junction diode and Zener diode

5 Input and output characteristics of BJT (CE, CB & CC configurations)

6 a) V-I and L-I characteristics of light emitting diode (LED).
b) V-I Characteristics of solar cell

7 Determination of Energy gap of a semiconductor.

8 R-C Circuit: To determine the time constant of R-C circuit.

9 Stewart–Gee's experiment: Determination of magnetic field along the axis of a current carrying Coil.

10 Determination of Bending losses of optical fiber.

11 a) Determination of wavelength of the given LASER beam using diffraction grating.
b) Determination of Acceptance Angle and Numerical Aperture of an optical fiber.

12 Understanding the method of least squares – Torsional pendulum as an example

Note: Any 8 experiments are to be performed.

REFERENCE BOOKS:

1 S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- I Sem

L	T	P	C
0	0	2	1

(22EC108ES) C PROGRAMMING FOR ENGINEERS LABORATORY

Course Outcomes: Upon completing this course, the students will be able to algorithms/flowcharts to programs (in C language).

1 Write algorithms and to draw flowcharts for solving problems and translate the
2 Use functions to develop modular reusable code.
3 Use arrays, pointers, strings and structures to formulate algorithms and programs
4 develop sample programs using dynamic memory allocation and Files I/O operations
5 Understand Searching and sorting algorithms

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1			1		1	1	2	2
CO2	3	2	3	2	1	2			1		1	1	2	2
CO3	3	3	2	1	1	2			1		1	1	2	3
CO4	3	3	3	2	1	1			1		1	1	2	3
CO5	3	3	3	2	1	1			1		1	1	2	3

List of Experiments:

1 Write a C program to find the sum of individual digits of a positive integer
2 Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
3 Write a C program to generate the first n terms of the sequence.
4 Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user
5 Write a C program to find the roots of a quadratic equation
6 Write a C program to find the factorial of a given integer.
7 Write a C program to find the GCD (greatest common divisor) of two given integers
8 Write a C program to solve Towers of Hanoi problem
9 Write a C program, which takes two integer operands and one operator from the user, performs the Operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
10 Write a C program to find both the largest and smallest number in a list of integers.
11 Write a C program that uses functions to perform the following:
i) Addition of Two Matrices ii) Multiplication of Two Matrices
12 Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n Characters from a given position in a given string.

13 Write a C program to determine if the given string is a palindrome or not

14 Write a C program that displays the position or index in the string S where the string T begins, or –1 if S doesn't contain T.

15 Write a C program to count the lines, words and characters in a given text

16 Write a C program to generate Pascal's triangle

17 Write a C program to construct a pyramid of numbers

18 Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$

For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Print x, n, the sum Perform error checking.

For example, the formula does not make sense for negative exponents – if n is less than 0.

Have your program print an error message if n<0, then go back and read in the next pair of numbers

of without computing the sum. Are any values of x also illegal? If so, test for them too.

19 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C Program to find the 2's complement of a binary number.

20 Write a C program to convert a Roman numeral to its decimal equivalent.

21 Write a C program that uses functions to perform the following operations:

i) Reading a complex number

ii) Writing a complex number

iii) Addition of two complex numbers

iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

22 i. Write a C program which copies one file to another.

ii. Write a C program to reverse the first n characters in a file. (Note: The file Name and n are specified on the command line.)

23 i. Write a C program to display the contents of a file.

ii. Write a C program to merge two files into a third file (i.e., the contents of the firs t file followed by those of the second are put in the third file)

24 Write a C program thatimplementsthefollowingsortingmethodstosortagivenlistofintegersin ascending order i) Bubble sort ii) Selection sort iii)Insertion sort

25 WriteCprogramsthatusebothrecursiveandnonrecursivefunctionstoperformthefollowing searching operations for a Key value in a given list of integers:

i) Linear search ii) Binary search

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- I Sem **L T P C**

0 0 2 1

(22EN109HS) ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

Course Outcomes: Upon completing this course, the students will be able to

1 Employ the nuances of English language through audio-visual experience and group Activities.

2 Articulate a neutral accent of English for intelligibility by overcoming mother tongue Influence.

3 Develop the skill of using appropriate language in various speaking contexts

4 Understand how to use language to make formal presentations.

5 Interpret speaking skills with clarity and confidence which in turn enhances their interpersonal skills

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					3	2			3	3		3		
CO2					3	3			3	3		3		
CO3						3			3	3		3		
CO4					3				3	3		3		
CO5									3	3		3		

Exercise – I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers Effective Listening.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs Consonant Clusters- Past Tense Marker and Plural Marker- Testing Exercises

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II

CALL Lab:

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress Pattern in sentences – Intonation.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - Testing Exercises

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.

Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III

CALL Lab:

Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -Testing Exercises

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions

Exercise – IV

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests - Testing Exercises

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication Presentation Skills.

Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests -Testing Exercises

ICS Lab:

Understand: Group Discussion

Practice: Group Discussion

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 Systems, with one Master Console, LAN facility and English language learning software for selfstudy by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration

ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audiovisual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video System and camcorder etc.

Source of Material (Master Copy):

Exercises in Spoken English. Part 1, 2, 3. CIEFL and Oxford University Press

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD
- Grammar Made Easy by Darling Kindersley
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University

Press.

- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- Digital All Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:

1 (2022). English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd.

2 Shobha, KN & Rayen, J. Lourdes. (2019). Communicative English – A workbook. Cambridge University Press

3 Kumar, Sanjay & Lata, Pushp. (2019). Communication Skills: A Workbook. Oxford University Press

4 Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.Orient Black Swan Pvt. Ltd.

5 Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

(22MA201BS) ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course out comes: Upon completing this course, the students will be able to

1. Identify whether the given differential equation of first order is exact or not
2. Apply the concept of differential equation to real world problems
3. Use the Laplace transforms techniques for solving ODE's
4. Use gradient to evaluate directional derivatives and conservative vector field
5. Calculate the line, surface and volume integrals and converting them from one to another.

Cos	**PROGRAMME OUTCOMES**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3		1	1							1		
CO2	1	2			2							2		
CO3	3	2		2										
CO4	2	1		2								1		
CO5	2	2										1		

UNIT- I First Order ODE

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

UNIT – II Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non- Homogeneous sterms of the Type^{eax}, sinax, cosax, polynomial sin$x$,$e^{axV(x)}$ and $xV(x)$, method of variation of parameters, Equations reducible to linear ODEwithconstantcoefficients: Legendre'sequation, CauchyEulerequation.

UNIT – III Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT – IV Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, So lenoidal and Irrotational vectors.

UNIT – V Vector Integration

Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their Applications

TEXTBOOKS:

1 B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2016
2 R.K.Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 10th Edition, 2020.

RFERENCE BOOKS:

1 Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition, John Wiley & Sons, 2018
2 G.B.Thomas and R.L.Finney, Calculus and Analytic geometry, 9 thEdition, Pearson, Reprint, 2002.
3 H.K .Dassand Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.
4 N.P.Baliand Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2018.
5 S.L. Ross, differential equations 3rd edition, Wiley India, 2007.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem

L	T	P	C
3	1	0	4

(22CH202BS) ENGINEERING CHEMISTRY

Course Outcomes: Upon completing this course, the students will be able to

1 Apply the principle of potable water for industrial and domestic purposes

2 Identify the electrolytic and electrochemical cells with different types of batteries and make use of corrosion control methods in industry

3 Explore the fundamental properties of polymers and other materials in engineering field.

4 Distinguish various types of fuels and their applications in day-to-day life

5 Develop understanding of engineering materials like cement, smart materials and Lubricants.

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				2	2					2		
CO2	3	2				2	2					3		
CO3	3	2				2	2					2		
CO4	3	2	1				2					3		
CO5	3	2					2					2		

UNIT- I Water and its treatment:

Introduction to hardness of water – Estimation of hardness of water by complex metric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water-Disinfection of potable water by chlorination and break-point chlorination. Defluoridation – Determination of F-ion by ion-selective electrode method. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods – Softening of water by ion- exchange processes. Desalination of water–Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion

Introduction-Classification of batteries primary, secondary and reserve batteries with examples. Basic Requirements for commercial batteries. Construction, working and applications of: Zn-air and Lithium ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.

Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – Mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods.

UNIT – III Polymeric materials:

Definition–Classification of polymers with examples– Types of polymerization– addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene

Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon.

Rubbers: Natural rubber and its vulcanization.

Elastomers: Characteristics– preparation– properties and applications of Buna-S, Butyl and Thiokol rubber.

FRP (Fiber reinforced plastics), GRP (Glass reinforced plastics), CRP (Carbon fiber reinforced plastics)- Introduction and applications.

Biodegradable polymers: Concept and advantages-Polylactic acid and Poly vinyl alcohol and their Applications.

UNIT – IV Energy Sources:

Introduction, Calorific value of fuel – HCV, LCV- Dulongs formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel– Transesterification, advantages.

UNIT – V Engineering Materials:

Cement: Portland cement, its composition, setting and hardening.

Smart materials and their engineering applications

Shape memory materials- Poly L-Lactic acid. Thermo response materials- Polyacryl amides, Poly vinyl amides

Lubricants: Classification of lubricants with examples-characteristics of a good lubricants–mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

TEXTBOOKS:

1 Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010
2 Engineering Chemistry by Rama Devi, P.Aparna and Rath, Cengage learning, 2022
3 A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K.Shashikala, Pearson Publications, 2021.
4 Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications

REFERENCEBOOKS:

1 Engineering Chemistry by Shikha Agarwal,Cambridge University Press, Delhi(2015)
2 Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company(P)Ltd. Delhi(2011)

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem	**L**	**T**	**P**	**C**
	1	**0**	**4**	**3**

(22ME204ES) COMPUTER AIDED ENGINEERING GRAPHICS

Course Objectives:

1. To develop the ability of visualization of different objects through technical drawings
2. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products

Course Outcomes: Upon completing this course, the students will be able to

1. Apply the principles of Engineering Graphics to create Engineering Drawings of various geometric constructions, conic sections, curves and scales as per BIS standards.
2. Construct orthographic projections for points, lines and planes in different quadrants And Auxiliary views.
3. Draw the sectional views and true shape of sections of solids, by applying principles of projections.
4. Draw the development of surfaces in real time situations
5. Develop isometric and orthographic views of the objects.

Cos	**PROGRAMME OUTCOMES**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2			2				1	1		1		
CO2	2	2			2				1	1		1		
CO3	2	2			2				1	1		1	1	
CO4	2	2			2				1	1		1	1	1
CO5	2	2			2				1	1		1	1	1

UNIT- I

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Scales – Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method only.Cycloid, Epicycloid and Hypocycloid, Introduction to Computer aided drafting – views, commands and conics

UNIT – II

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections – points, lines and planes

UNIT – III

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views, Co Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa –Conventions. Conversion of orthographic projection into isometric view using computer aided drafting.

UNIT – IV

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Development of surfaces using computer aided drafting

UNIT – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa –Conventions. Conversion of orthographic Projection into isometric view using computer aided drafting.

TEXTBOOKS:

1 Engineering Drawing N.D. Bhatt / Charotar

2 Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapoovan, Vikas: S.Chand and company Ltd.

REFERENCEBOOKS:

1 Engineering Drawing, Basant Agrawal and C M Agrawal, Third Edition McGraw Hill

2 Engineering Graphics and Design, WILEY, Edition 2020

3 Engineering Drawing, M. B. Shah, B.C. Rane / Pearson

4 Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford

5 Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

Note: - External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem

L	T	P	C
2	0	0	2

(22EE204ES) BASIC ELECTRICAL ENGINEERING

Prerequisites: Mathematics

Course Objectives:

- To understand DC and Single &Three phase AC circuits
- To study and understand the different types of DC, AC machines and Transformers
- To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

Course Outcomes: Upon completing this course, the students will be able to

CO1 . Verify the basic Electrical circuits through different experiments.

CO2. Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.

CO3. Analyze the transient responses of R, L and C circuits for different input conditions.

CO4. To determine the performance of different types of DC, AC machines and Transformers.

CO5 .To import the knowledge of various electrical installations and the concept of power, Power factor and its improvement.

Course Outcomes	PROGRAMME OUTCOMES											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3			2	2	1						1
CO2	2	2	2		2	2				1		1
CO3	1		3	1		3					2	
CO4	1	2	3		1					1		1
CO5	1	1	3	2	2	1						2

UNIT- I

D.C. Circuits: Electrical circuit elements(R,L and C),voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Super position, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT – II

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R,L,C,RL,RC,RLC combinations (series and parallel),resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT – III

Transformers: Construction and working principle of transformer and EMF equation, Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT – IV

Electrical Machines: Construction and working principle of dc machine, performance characteristics of dc shunt machine. Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Significance of torque slip characteristics. Construction and working of Single-phase induction motor.

UNIT – V

Electrical Installations: Components of LTS witch gear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption, power factor improvement, factors for low voltage electrical installations and requirements.

TEXTBOOKS:

1 D.P.KothariandI.J.Nagrath,"BasicElectricalEngineering",TataMcGrawHill,4th Edition,2019.

2 MSNaiduandSKamakshaiah,"BasicElectricalEngineering",TataMcGrawHill,2nd Edition,2008

REFERENCEBOOKS:

1 P. Ramana, M.Suryakalavathi ,G.T. Chandrasheker ,"Basic Electrical Engineering",S.Chand,2nd Edition,2019

2 D.C.Kulshreshtha,"Basic Electrical Engineering",Mc Graw Hill, 2009.

3 M.S.Sukhija,T.K.Nagsarkar,"Basic Electrical and Electronics Engineering",Oxford,1st Edition,2012

4 Abhijit Chakrabarthi, Sudipta Debnath,Chandan Kumar Chanda,"Basic Electrical Engineering",2nd Edition, Mc Graw Hill,2021.

5 L.S.Bobrow,"Fundamentals of Electrical Engineering",Oxford University Press, 2011.

6 E.Hughes,"Electrical and Electronics Technology",Pearson,2010.

7 V. D.Toro, "Electrical Engineering Fundamentals", Prentice Hall India,1989

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem	**L**	**T**	**P**	**C**
	2	**0**	**0**	**2**

(22EC205ES) ELECTRONIC DEVICES AND CIRCUITS

Course Objectives:

1 To introduce components such as diodes, BJTs and FETs.
2 To know the applications of devices
3 To know the switching characteristics of devices
4 To know the clipping concepts of a signal

Course Outcomes: Upon completion of the Course, the students will be able to:

1 Apply the concepts of Diode applications.
2 Apply concepts of Non-Linear application in solving various problems.
3 Analyse the switching concepts of BJT
4 Compare BJT with FET and MOSFET
5 Design circuits using Special Purpose Devices

Course Outcomes	**PROGRAMME OUTCOMES**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	-	-	1	1	-	-	-	-	1		
CO2	3	2	1	1	-	2	1	-	-	-	-	1		
CO3	3	3	1	1	-	2	1	-	-	-	-	1		
CO4	3	2	2	1							1	1	1	
CO5	3	2	2	1							1	1	2	

UNIT- I

Diodes: Diode - Static and Dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances, V-I Characteristics, Diode as a switch- switching times.

UNIT – II

Diode Applications: Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

UNIT – III

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times,

UNIT – IV

Junction Field Effect Transistor (FET): Construction, Principle of Operation, Pinch-Off Voltage, VoltAmpere Characteristic, Comparison of BJT and FET, FET as Voltage Variable Resistor, MOSFET, MOSTET as a capacitor.

UNIT – V

Special Purpose Devices: Zener Diode - Characteristics, Zener diode as Voltage Regulator, Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

TEXTBOOKS:

1 Jacob Millman - Electronic Devices and Circuits, McGraw Hill Education

2 Robert L. Boylestead, Louis Nashelsky- Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson.

REFERENCEBOOKS:

1 Horowitz -Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford

2 Chinmoy Saha, Arindam Halder, Debaati Ganguly - Basic Electronics-Principles and Applications, Cambridge, 2018.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem

L	T	P	C
0	1	2	2

(22EC206ES) APPLIED PYTHON PROGRAMMING LABORATORY

Course Objectives:

1 To Learn basic concepts of Python programming.
2 To develop Python programs with conditionals and loops statements.
3 To define Python functions, packages.
4 To expose the student to the run python programming on IoT Devices

Course Outcomes: Upon completing this course, the students will be able to

1 Build basic programs using fundamental programming constructs
2 Write and execute python codes for small basic applications
3 Implementing modular approach using python
4 Understand how to use numpy, scipy and other packages
5 Capable to implement IOT based programs using python and Raspberry Pi.

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	1	-	-	-	1	-	1	1	1	1
CO2	1	3	1	1	1	-	-	-	1	-	1	1	1	
CO3	1	3	1	1	1	-	-	-	1	-	1	1		
CO4	1	3	1	1	1	-	-	-	1	-	1	1		
CO5	1	3	1	1	1	-	-	-	1	-	1	1		

LIST OF EXPERIMENTS:

Cycle - 1

1 Downloading and Installing Python and Modules
   a) Python 3 on Linux
   Follow the instructions given in the URLhttps://docs.python-guide.org/starting/install3/linux/
   b) Python 3 on Windows
   Follow the instructions given in the URLhttps://docs.python.org/3/using/windows.html
   (Please remember that Windows installation of Python is harder!)
   c) pip3 on Windows and Linux
   Install the Python package installer by following the instructions given in the URL https://www.activestate.com/resources/quick-reads/how-to-install-and-use-pip3/
   d) Installing numpy and scipy
   You can install any python3 package using the command pip3 install <packagename> e) Installing jupyterlab
   Install from pip using the command pip install jupyter lab
2 Introduction to Python3
   a. Printing your biodata on the screen

b. Printing all the primes less than a given number
c. Finding all the factors of a number and show whether it is a *perfect* number, i.e., the sum of all its factors (excluding the number itself) is equal to the number itself

3 Defining and Using Functions

a. Write a function to read data from a file and display it on the screen
b. Define a boolean function *is palindrome*(<input>)
c. Write a function *collatz(x)* which does the following: if x is odd, $x = 3x + 1$; if x is even, then $x = x/2$. Return the number of steps it takes for $x = 1$
d. Write a function $N(m, s) = exp(-(x-m)^2/(2s^2))/sqrt(2\pi)s$ that computes the Normal distribution

4 The package numpy

a. Creating a matrix of given order $m \times n$ containing *random numbers* in the range 1 to 99999
b. Write a program that adds, subtracts and multiplies two matrices. Provide an interface such that, based on the prompt, the function (addition, subtraction, multiplication) should be performed
c. Write a program to solve a system of n linear equations in n variables using matrix inverse
d. The package scipy and pyplot
e. Finding if two sets of data have the same *mean* value
f. Plotting data read from a file
g. Fitting a function through a set a data points using *polyfit*function
h. Plotting a histogram of a given data set

5 The strings package

a) Read text from a file and print the number of lines, words and characters
b) Read text from a file and return a list of all n letter words beginning with a vowel
c) Finding a secret message hidden in a paragraph of text
d) Plot a histogram of words according to their length from text read from a file

6 4. Cycle -2 Installing OS on Raspberry Pi

a. Installation using PiImager
b. Installation using image file

- Downloading an Image
- Writing the image to an SD card
- using Linux
- using Windows
- Booting up

Follow the instructions given in the URL
https://www.raspberrypi.com/documentation/computers/getting-started.html

7 Accessing GPIO pins using Python

a. Installing GPIO Zero library. First, update your repositories list: *sudo apt update*
Then install the package for Python 3:
sudo apt install python3-gpiozero
b. Blinking an LED connected to one of the GPIO pin
c. Adjusting the brightness of an LED
d. Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

8 Collecting Sensor Data

a. DHT Sensor interface

- Connect the terminals of DHT GPIO pins of Raspberry Pi
- Import the DHT library using *import Adafruit_DHT*
- Read sensor data and display it on screen.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem

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0	0	2	1

(22CH207BS) ENGINEERING CHEMISTRY LABORATORY

Course Outcomes: Upon completing this course, the students will be able to

1 Determination of parameters like hardness of water and rate of corrosion of mild steel in various conditions

2 Performing experimental methods such as conductometry, potentiometry and pH metry in order to find out the concentrations or equivalence points of acids and bases.

3 Preparation of polymers like Bakelite and nylon-6

4 Estimation of saponification value, surface tension and viscosity of lubricant oils

5 Estimation of different types of qualitative and quantitative measurements of a given compound

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		1			2					2		
CO2	2	2					2					2		
CO3	2	2				1	2					2		
CO4	3	2				2	2					2		
CO5	3	2		2								2		

List of Experiments:

I **Volumetric Analysis:**
1. Estimation of Hardness of water by EDTA Complexometry method.
2. Estimation of Fe2+ by Dichrometry.

II **Conductometry:** Estimation of the concentration of an acid by Conductometry.

III **Potentiometry:** Estimation of the amount of Fe+2 by Potentiomentry.

IV pH Metry: Determination of an acid concentration using pH meter.

V **Preparations:**
1. Preparation of Bakelite.
2. PreparationNylon–6.

VI **Lubricants:**
1. Estimation of acid value of given lubricant oil Estimation of Viscosity of lubricant oil using Ostwald's Viscometer
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer

VI I **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

VI II **Virtual lab experiments**
1. Construction of Fuel cell and its working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

REFERENCEBOOKS:

1 Lab manual for Engineering chemistry by B.Ramadevi and P.Aparna, S Chand Publications, New Delhi (2022)
2 Vogel's textbook of practical organic chemistry 5 th edition
3 Inorganic Quantitative analysis by A.I.Vogel, ELBS Publications
4 College Practical Chemistry byV.K.Ahluwalia, Narosa Publications Ltd.NewDelhi (2007).

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem **L T P C**

0 0 2 1

(22EE208ES) BASIC ELECTRICAL ENGINEERING LABORATORY

Prerequisites: Basic Electrical Engineering

Course Objectives:

- To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
- To study the transient response of various R,L and C circuits using different excitations.
- To determine the performance of different types of DC, AC machines and Transformers.

Course Outcomes: Up on completing this course, the students will be able to

CO1 : Verify the basic Electrical DC and AC circuits through different experiments

CO2: Evaluate the performance calculations of Transformers through various testing methods.

CO3: Evaluate the performance calculations of DC Electrical Machines through various testing methods.

CO4: Evaluate the performance calculations of AC Electrical Machines through various testing methods.

CO5: Analyze the simple circuit for lighting and power installations.

CO'S	Program Outcomes											
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2
CO1	3	2	1		1				2		2	2
CO2	3	2	1	1	3	2			1		2	2
CO3	2	1	1		1		1		2	1	2	1
CO4	3	2	2	1	3	1		1	2	2	1	2
CO5	2	3	1	1	1	2			1		2	1

List of experiments/demonstrations:

PART-A (compulsory)

1 Verification of KVL and KCL

2 Verification of Thevenin's and Norton's theorem

3 Transient Response of Series RL and RC circuits for DC excitation

4 Resonance in series RLC circuit

5 Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits

6 Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer

7 Performance Characteristics of a DC Shunt Motor

8 Torque-Speed Characteristics of a Three-phase Induction Motor.

PART-B (any two experiments from the given list)

1 Verification of Superposition theorem

2 Three Phase Transformer: Verification of Relationship between Voltages and Currents(Star-Delta, Delta-Delta, Delta-star, Star-Star)

3 Load Test on Single Phase Transformer(Calculate Efficiency and Regulation)

4 Prepare a meter board for lighting and power installation using MCB, energy meter, fuse unit, DP switch, indicators and bus bars.

TEXTBOOKS:

1 D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.

2 MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCEBOOKS:

1 P. Ramana, M. Suryakalavathi, G.T.Chandrasheker,"Basic Electrical Engineering", S. Chand,2nd Edition,2019.

2 D.C.Kulshreshtha,"Basic Electrical Engineering",Mc Graw Hill,2009

3 M.S.Sukhija, T.K.Nagsarkar,"BasicElectricalandElectronicsEngineering", Oxford,1stEdition,2012.

4 Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering",2ndEdition, Mc Graw Hill, 2021.

5 L.S.Bobrow,"Fundamentals of Electrical Engineering",Oxford University Press, 2011.

6 E.Hughes,"Electrical and Electronics Technology",Pearson,2010.

7 V. D.Toro,"Electrical Engineering Fundamentals",Prentice Hall India,1989.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

I Year B.Tech. ECE- II Sem

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0	0	2	1

(22EC209ES) ELECTRONIC DEVICES AND CIRCUITS LABORATORY

Course Outcomes: Up on completing this course, the students will be able to

1 Acquire the knowledge of various semiconductor devices and their use in real life
2 Designing of clippers and clampers for various reference voltage levels
3 Design aspects of biasing for various configurations of BJT
4 Design aspects of biasing for various configurations of FET
5 Acquire the knowledge about the role of special purpose devices and their applications

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	3	-	-	1	1	-	-	1	1	
CO2	3	2	2	-	3	-	-	1	1	-	-	1	1	
CO3	3	2	2	-	3	-	-	1	1	-	-	1	1	
CO4	3	2	3		2			1	1			1	2	1
CO5	3	1	2		2			1	1			1	1	

List of Experiments (Twelve experiments to be done): Verify any twelve experiments in H/W Laboratory

1 PN Junction diode characteristics A) Forward bias B) Reverse bias
2 Full Wave Rectifier with & without filters
3 Types of Clippers at different reference voltages
4 Types of Clampers at different reference voltages
5 The steady state output waveform of clampers for a square wave input
6 Input and output characteristics of BJT in CB Configuration
7 Input and output characteristics of BJT in CE Configuration
8 Input and output characteristics of BJT in CC Configuration
9 Input and output characteristics of MOS FET in CS Configuration
10 Input and output characteristics of MOS FET in CD Configuration
11 Switching characteristics of a transistor
12 Zener diode characteristics and Zener as voltage Regulator
13 SCR Characteristics.
14 UJT Characteristics and identify negative region
15 Photo diode characteristics
16 Solar cell characteristics
17 LED Characteristics
*Design a circuit to switch on and off LED using diode/BJT/FET as a switch.

Major Equipment required for Laboratories:

1 Regulated Power Suppliers, 0-30V
2 20 MHz, Dual Channel Cathode Ray Oscilloscopes
3 Functions Generators-Sine and Square wave signals Multimeters, voltmeters and Ammeters
4 Electronic Components and devices

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- I Sem

L	T	P	C
3	1	0	4

(22MA301BS) NUMERICAL METHODS AND COMPLEX VARIABLES

Course Outcomes: Up on completing this course, the students will be able to

- Express any periodic function in terms of sine and cosine
- Find the root of a given poly nominal and transcendental equations and estimate the value for the
- Find the numerical solutions for a given first order ODEs
- Analyze the complex function with reference to their analyticity, integration using Cauchy's and residue theorems and transformations on different planes. Integral
- Apply Taylor's and Laurent' series expansions in complex function

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2			2							1		
CO2	2	1			2							1		
CO3	2	2			1							1		
CO4	1	2		2								1		
CO5	1	2										1		

UNIT- I : Fourier series & Fourier Transforms:
Fourier series- Dirichlet's Conditions - Halfrange Fourier series-Fourier Trans forms: Fourier Sine and cosine transforms-Inverse Fourier transforms

UNIT – II : Numerical Methods-I
Solution of polynomial and transcendental equations: Bisection method, Iteration Method, Newton-Raphs on method and Regula- Falsi method. Finite differences: forward differences, backward differences, central differences, symbolic relations and separation of symbols, Interpolation using Newton's forward and back ward difference formulae. Central difference interpolation: Gauss'sforward and back ward formulae, Lagrange's method of interpolation.

UNIT – III : Numerical Methods- II
Numerical integration: Trapezoidal rule and Simpson's1/3rd and 3/8th rules. Ordinary differential equations: Taylor's series, Picard's method, Euler and modified Euler's methods, Runge - Kutta method of fourth order for first order ODE

UNIT – IV : Complex Differentiation
Limit, Continuity and Differentiation of Complex functions. Cauchy- Riemann equations (without proof), Milne- Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate, conformal mappings and Mobius transformations

UNIT – V : Complex Integration:
Line integrals, Cauchy's theorem, Cauchy's Integral formula, zeros of analytic functions, singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem. And their properties.(All theorems without Proofs)

TEXTBOOKS:

1 B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2016.
2 S.S. Sastry, Introductory methods of numerical analysis, PHI, 5th Edition, 2012.

REFERENCEBOOKS:

1 Jain, S.R.K.Iyengar, R.K.Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
2 .Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition, John Wiley & Sons, 2018
3 J.W. Brownand R.V.Churchill, Complex Variables and Applications, 8th Edition, McGraw Hill, 2017.
4 Schaum's Outline of Complex Variables, 2nd Ed

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

(22EC301PC) ANALOG CIRCUITS

Pre-requisite: Electronic Devices and Circuits

Course Objectives:

1 Learn the concepts of, load line analysis and biasing techniques
2 Learn the concepts of high frequency analysis of transistors.
3 To give understanding of various types of amplifier circuits
4 Learn the concepts of small signal analysis of BJT and FET
5 To familiarize the Concept of feedback in amplifiers

Course Outcomes: Upon completing this course, the students will be able to

1 Apply various biasing technique in design of amplifiers
2 Analyze single stage amplifiers using BJT and FET
3 Distinguish various multistage amplifier circuits using BJT
4 Utilize the Concepts of negative feedback to improve the stability of amplifiers
5 Design various oscillator circuits

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	1	1	-
CO2	3	2	2		-	-	-	-	-	-	-	1	1	-
CO3	3	2	1		-	-	-	-	-	-	-	1	1	-
CO4	3	2	2		-	-	-	-	-	-	-	1	1	-
CO5	3	3	2	1	-	-	-	-	-	-	-	1	1	-

UNIT- I :

BJT Biasing: Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diode Analysis and Design of Small Signal Low Frequency BJT Amplifiers: Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE,CB and CC configurations, Transistor amplifying action, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

UNIT – II :

ET- Biasing Techniques FET Amplifiers: Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOSFET Amplifiers, MOS Small signal model, Common source amplifier with resistive, Diode connected and Current source loads, Source follower, Common Gate Stage.

UNIT – III :

Multistage Amplifiers: Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade RC Coupled amplifiers, Cascode amplifier, Darlington pair. Transistor at High Frequency: Hybrid - model of Common Emitter transistor model, fα, fβ and unity gain bandwidth, Gain-bandwidth product.

UNIT – IV :

Feedback Amplifiers: Concepts of feedback – Classification 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 configurations – Simple problems.

UNIT – V :

Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wienbridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

TEXTBOOKS:

1 Jacob Millman, Christos C Halkias -Integrated Electronics, McGraw Hill Education
2 Robert L. Boylestead, Louis Nashelsky -Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson

REFERENCEBOOKS:

1 David A. Bell – Electronic Devices and Circuits, 5 th Edition, Oxford
2 Adel S. Sedra, Kenneth C. Smith- Microelectronic Circuits- Theory and Applications, Oxford.
3 Chinmoy Saha, Arindam Halder, Debaati Ganguly -Basic Electronics-Principles and Applications, 2018, Cambridge.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- I Sem

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3	0	0	3

(22EC302PC) NETWORK ANALYSIS AND SYNTHESIS

Pre-requisite: Basic Electrical Engineering

Course Objectives:

1 To understand the basic concepts on RLC circuits
2 To know the behavior of the steady state and transient states in RLC circuits.
3 To understand the two port network parameters.
4 Learn the design concepts of various filters and attenuator.
5 To synthesize a circuit with the specified response.

Course Outcomes: Up on completing this course, the students will be able to

1 Apply RLC network concepts in solving electrical and magnetic circuits.
2 Analyse the Steady state and transient analysis of RLC Circuits. .
3 Calculate two port network parameters
4 Analyse the Design aspect of various filters and attenuators.
5 Determine the elements required to network synthesis methods

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO2	3	2	3	2	-	-	-	-	-	-	-	1	2	3
CO3	3	3	2	2	-	-	-	-	-	-	-	2	2	3
CO4	3	2	2	1	-	-	-	-	-	-	-	1	1	2
CO5	3	2	2	2	-	-	-	-	-	-	-	1	1	2

UNIT- I :

Network Topology: Basic cutset and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

UNIT – II :

Transient and Steady state analysis: RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, quality factor and bandwidth for series and parallel resonance, resonance curves.

UNIT – III :

Two port network parameters: Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard TL Sections, Characteristic impedance, image transfer constants, impedance matching network.

UNIT – IV :

Filters: Classification of Filters, Filter Networks, Constant-K Filters-Low pass, high pass, Band pass, band-stop filters, M-derived Filters- T and π filters- Low pass, high pass Attenuators: Types – T, π , L, Bridge T and lattice ,Asymmetrical Attenuators T, π , L Equalizers Types- Series, Shunt, Constant resistance, bridge T attenuation, bridge T phase, Lattice attenuation, lattice Phase equalizers

UNIT – V :

Network Synthesis: Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non ladder networks, Poles, Zeros analysis of network functions

TEXTBOOKS:

1 Van Valkenburg -Network Analysis, 3 rd Ed., Pearson, 216.
2 JD Ryder - Networks, Lines and Fields, 2 nd Ed., PHI, 1999.

REFERENCEBOOKS:

1 J. Edminister and M. Nahvi - Electric Circuits, Schaum's Outlines, McGraw Hills ducation,1999.
2 A. Sudhakar and Shyammohan S Palli - Networks & Circuits, 4 th Ed., Tata McGraw- Hill Publications
3 William Hayt and Jack E. Kimmerley - Engineering Circuit Analysis, 6th Ed., William Hayt and Jack E. Kimmerley, McGraw Hill Company

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- I Sem	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(22EC303PC) DIGITAL LOGIC DESIGN

Pre-requisite:

Course Objectives:

- To understand common forms of number representation in logic circuits
- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems
- To understand the concepts of combinational logic circuits and sequential circuits.
- To understand the Realization of Logic Gates Using Diodes & Transistors

Course Outcomes: Up on completing this course, the students will be able to

1 Acquire the knowledge on various types of number system and reduce the Boolean expressions using theorem and properties
2 Minimize the Boolean functions using K-map and Tabular methods and Characterize logic Families and compare them with their specifications
3 Design the Combinational and sequential circuits for various cyclic functions.
4 Draw the state table for the register and counters and design the N bit UP/DOWN Counters using flip flops.
5 Design the sequential Machines using Moore and Mealy models

Course Outcomes	**PROGRAMME OUTCOMES**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2			2			2			2
CO2	3	3	3	2		1			1			2
CO3	3	3	2	3		2			2			3
CO4	3	3	3	3		2			1			1
CO5	3	3	2	3		2			2			1

UNIT- I :

Number Systems: Number systems, Complements of Numbers, Codes- Weighted and No weighted codes and its Properties, Parity check code and Hamming code.

Boolean algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT – II :

Minimization of Boolean functions: Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method Realization of Logic Gates Using Diodes & Transistors: AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate-Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tri-state outputs, IC interfacing- TTL driving CMOS & CMOS driving TTL.

UNIT – III :

Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

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

UNIT – IV :

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

Sequential Machines: Finite State Machines, Synthesis of Synchronous Sequential Circuits Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N – Counters.

UNIT – V :

Finite state machine: capabilities and limitations, Mealy and Moore models, State equivalence and machine minimization, simplification of incompletely specified machines, Merger graphs. Asynchronous design-modes of operation, Hazards, synthesis of SIC fundamental mode circuits, synthesis of burst mode circuits. Introduction to ASM Charts

TEXTBOOKS:

1 Zvi Kohavi &Niraj K. Jha, - Switching and Finite Automata Theory, 3rd Ed., Cambridge, 2010.
2 R. P. Jain - Modern Digital Electronics, 3rd Edition, 2007- Tata McGraw-Hill

REFERENCEBOOKS:

1 Morris Mano, Fredriac J. Hill, Gerald R. Peterson - Introduction to Switching Theory and LogicDesign –3rd Ed., John Wiley & Sons Inc
2 Charles H. Roth - Fundamentals of Logic Design, 5 th ED., Cengage Learning, 2004

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- I Sem

L	T	P	C
3	1	0	4

(22EC304PC) SIGNALS AND SYSTEMS

Course Objectives: The objectives of this subject are to:

1 Classify signals and systems and their analysis in time and frequency domains
2 Study the concepts of distortion less transmission through LTI systems, convolution and correlation properties.
3 Understand Laplace and Z-transforms their properties for analysis of signals and systems.
4 Identify the need for sampling of CT signals, types and merits and demerits of each type.

Course Outcomes: Upon completing this course the students able to:

1 Apply the concept of orthogonality on signals and systems
2 Analyze the concepts of Fourier series and Fourier Transform techniques for given Specifications.
3 Analyze system characteristics for given specifications
4 Estimate ROC and stability conditions of S and Z domains for given conditions
5 Design system using the concept of sampling theorem and correlation

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	3	-	-	-	-	-	2	3	3
CO2	3	2	2	-	-	2	-	-	-	-	-	3	3	2
CO3	3	3	3	-	-	3	-	-	-	-	-	2	3	3
CO4	3		2	-	-	1	-	-	-	-	-	3	3	3
CO5	3	3	3	-	-	1	-	-	-	-	-	2	2	2

UNIT- I :

Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function

UNIT – II :

Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

UNIT – III :

Signal Transmission through Linear Systems: Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a

system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley ac.in -Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency Domain, Graphical representation of Convolution.

UNIT – IV :

Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a Signal, Laplace Transform of certain signals using waveform synthesis.

Z–Transforms: Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

UNIT – V :

Sampling theorem: Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

Correlation: Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering

TEXTBOOKS:

1 B.P. Lathi -Signals, Systems & Communications, BSP, 2013.
2 A.V. Oppenheim, A.S. Willsky and S.H. Nawabi -Signals and Systems, 2 nd Ed., Prentice Hall

REFERENCEBOOKS:

1 Simon Haykin and Van Veen, A. Rama Krishna Rao, -Signals and Systems, TMH, 2008
2 Michel J. Robert - Fundamentals of Signals and Systems, MGH International Edition, 2008.
3 C. L. Philips, J. M. Parr and Eve A. Riskin -Signals, Systems and Transforms, 3rd Ed., PE,2004

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II Year B.Tech. ECE- I Sem

L	T	P	C
0	0	2	1

(22EC305PC) ANALOG CIRCUITS LABORATORY

Course Outcomes: Upon completing this course the students able to:

1 Design amplifiers with required Q point and determine the stability factors.
2 Analyze transistor characteristics and calculate its parameters.
3 Design high frequency model of BJT to calculate gain bandwidth product
4 Examine the effect of amplification on frequency response. .
5 Investigate feedback concept in amplifiers and oscillator.

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	3	-	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	1	-
CO3	1	1	3	-	-	-	-	-	-	-	-	1	1	-
CO4	1	2	2	3	-	-	-	-	-	-	-	1	1	-
CO5	1	2	2	3	-	-	-	-	-	-	-	1	1	-

List of Experiments (Twelve experiments to be done):

Verify any twelve experiments in H/W Laboratory

1 Perform an experiment to choose Q-point for a Transistor that operate in active region and observe the effect of external Load resistance on Q-point.
2 Design a Self bias Circuit and determine the Q-point of the transistor and its stability factor
3 Obtain the I/O Characteristics of CE, CB, and CC Configurations. Calculate hparameters from theCharacteristics.
4 Design a Common Drain Amplifier with voltage divider bias and determine the Stability factor.
5 Obtain the Drain and Transfer characteristics of CD, CS Configurations of JFET. Calculate gm, rd from the Characteristics.
6 By experiment prove that the voltage gain of Emitter Follower Circuit is one.
7 Design a Common Emitter Amplifier with a gain of 30db and Bandwidth of 10KHZ and plot thefrequency response practically.
8 Design a two stage RC Coupled amplifier and prove that gain is increased and analyze heeffects of coupling capacitance.
9 Practically prove that the Darlington pair has high input impedance
10 Draw the high frequency response of common emitter transistor amplifier and calculate fα, fβ and gain bandwidth product.
11 Design a Cascode amplifier and draw the frequency response of it

12 Design four topologies of feedback amplifiers and draw the frequency response of them with and without feedback.

13 Design an RC phase shift oscillator circuit and derive the gain condition for oscillations practically for given frequency.

14 Design a Colpitts oscillator circuit for the given frequency and draw the output Waveform.

Major Equipment required for Laboratories:

1 Regulated Power Suppliers, 0-30V
2 20 MHz, Dual Channel Cathode Ray Oscilloscopes
3 1 MHz Functions Generators-Sine and Square wave signals
4 Multimeters
5 Electronic devices

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- I Sem

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(22EC306PC) DIGITAL LOGIC DESIGN LABORATORY

Course Outcomes: Up on completing this course, the students will be able to

1 Acquire the knowledge on numerical information in different forms and Boolean Algebra theorems
2 Define Postulates of Boolean algebra and to minimize combinational functions, and Design the combinational circuits.
3 Design and analyze sequential circuits for various cyclic functions.
4 Characterize the logic families and analyze the mforthe purpose of AC and DC parameters.
5 Design and analyze the Finate state machines-FSM's

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	2	1	-	-	1	-	-	2		
CO2	3	2	2	1	2	1	-	-	1	-	-	2		
CO3	2	3	3	2	2	1	-	-	1	-	-	1		
CO4	3	2	1	1	1	-	-	-	-	-	-	-	1	
CO5	3	2	3	1	2	1	-	-	-	-	2	1	1	

List of Experiments

1 Realization of Logic circuit to generate r's Compliment using Logic Gates
2 Realization of given Boolean function using universal gates and minimizing the same.Compare the gate count before and after minimization.
3 Design and realize Full Adder circuit using gates/universal gates. Implement Full Subtract or using full adder
4 Designing a 2 – bit Comparator using AND, OR and NOT gates. Realize 4 – bit Comparator using 2 – bit Comparators
5 Realize 2:1 MUX using the given gates and Design 8:1 using 2:1 MUX
6 Implement the given Boolean function using the given MUX(ex: code converters)
7 Realize a 2x4 Decoder using logic gates and implement 3x8 Decoder using 2x4 Decoder
8 Implement the given Boolean function using given Decoders.
9 Convert Demultiplexer to Decoder and vise versa
10 Verification of truth tables of flip-flops using different clocks (level triggering, positive and negative edge triggering) also converts the given flipflop from one type to other
11 Designing of Universal n-bit shift register using flipflops and Multiplexers. Draw the timing diagram of the Shift Register.
12 Design a Synchronous binary counter using D-flipflop/given flipflop
13 Design a asynchronous counter for the given sequence using given flipflops
14 Designing of MOD 8 Counter using JK flipflops
15 Designing of sequence detecting State Machine with minimal states using the given flip-flops.

16 Designing of Parity Bit(even/odd) generator using the given flipflops

17 Realize all logic gates with TTL logic. 18. Realize all logic gates with DTL logic. *Design a sequence detector to detect a given sequence and verify practically *Design a serial subtractor for 4 bit binary numbers

Major Equipment required for Laboratories:

1 5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply

2 20 MHz Oscilloscope with Dual Channel.

3 Bread board and components/ Trainer Kit. 4. Multimeter.

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II Year B.Tech. ECE- I Sem

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0	0	2	1

(22EC307PC) BASIC SIMULATION LABORATORY

Course Outcomes: Upon completing this course ,the students will be able to

1 Practice the characteristics of signals and its operations
2 Demonstrate the concept of Correlation and Convolution on given signals and sequences.
3 Analyze the different types of systems to obtain their characteristics
4 Analyze the given signal using wiener-khin chin relation and noises
5 Estimate a given system for observing its LTI & Response characteristics

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	2	2	-	-	-	-	3	2	3
CO2	3	3	3	-	3	3	1	-	-	-	-	2	2	3
CO3	3	3	3	-	2	2	3	-	-	-	-	3	2	3
CO4	3	3	3	-		3	3	-	-	-	-	1	2	3
CO5	3	2	2	-	2	2	3	-	-	-	-	1	3	2

Note:

- All the experiments are to be simulated using MATLAB or equivalent software
- Minimum of 15 experiment are to be completed

List of Experiments

1 Basic Operations on Matrices.
2 Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3 Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4 Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal
5 Convolution for Signals and sequences
6 Auto Correlation and Cross Correlation for Signals and Sequences
7 Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System
8 Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realiazability and stability properties
9 Gibbs Phenomenon Simulation.
10 Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum

11 Waveform Synthesis using Laplace Transform.

12 Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.

13 Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew, Kurtosis, and PSD, Probability Distribution Function.

14 Verification of Sampling Theorem.

15 Removal of noise by Autocorrelation / Cross correlation.

16 Extraction of Periodic Signal masked by noise using Correlation.

17 Verification of Weiner-Khinchine Relations.

18 Checking a Random Process for Stationary in Wide sense.

Major Equipment required for Laboratories:

1 Computer System with latest specifications connected

2 Window Xp or equivalent

3 Simulation software-MAT Lab or any equivalent simulation software

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- I Sem

L	T	P	C
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(22MC310) CONSTITUTION OF INDIA

Course Objectives: Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the Emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impacton the in iti drafting of the Indian Constitution.

Course Outcomes: Up on completing this course, the students will be able to

1 Explain the background of the present constitution of India and features.
2 Utilize the fundamental rights and duties
3 Understand the working of the union executive, parliament and judiciary.
4 Understand the working of the state executive, legislature and judiciary
5 Utilize the special provisions and statutory institutions..
6 Show national and patriotic spirit as responsible citizens of the country.

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	2		2			2	
CO2						3	3	3		3			2	
CO3						3	2	3		3			2	
CO4						3	2	3		3			3	
CO5						3	2	3		3			3	
CO6						3	3	3		2			3	

Unit-1 History of Making of the Indian Constitution-History of Drafting Committee

Unit-2 Philosophy of the Indian Constitution-Preamble Salient Features.

Unit- 3 Contours of Constitutional Rights Duties-Fundamental Rights

- Right to Equality
- Right to Freedom
- Right a gainst Exploitation
- Right to Freedomo of Religion
- Cultural and Educational Right
- Right to Constitutional Remedie
- Directive Principles of State Policy
- Fundamental Duties

Unit - 4 Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary,

appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit - 5 Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO
Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit-6 Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:

1 The ConstitutionofIndia,1950 (BareAct),Government Publication

2 Dr.S.N.Busi,Dr.B.R.AmbedkarframingofIndianConstitution,1stEdition,2015

3 M.P.Jain, Indian Constitution Law,7thEdn.,LexisNexis,2014

4 D.D.Basu,Introductionto the Constitution of India, Lexis Nexis,2015

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- II Sem	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(22EC401PC) PROBABILITY THEORY AND STOCHASTIC PROCESSES

Pre-requisite: Mathematics.

Course Objectives:

1 This gives basic understanding of random Variable and Probability.
2 This gives basic understanding of operations on single and multiple random variables
3 To known the temporal characteristics of Random Process.
4 To Learn the Basic concepts of Noise sources in Communication systems.
5 To known the Spectral characteristics of Random Process

Course Outcomes: Up on completing this course, the students will be able to:

1 Apply the Concepts of probability and Random variable to real time Applications
2 Analyze probability density and distribution functions for random variables
3 Determine the temporal characteristics of random processes.
4 Evaluate the spectral density of random Processes.
5 Use the concepts of noise and information theory in communication systems.

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													2
CO2	3	3	3	2										3
CO3	3	3	3	2										2
CO4	3	3	3	2										3
CO5	3		3	2										2

UNIT - I

Probability & Random Variable: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events, Random Variable-Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties

UNIT - II

Operations on Single & Multiple Random Variables – Expectations: Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic and Non-monotonic Transformations of Continuous Random

Variable, Transformation of a Discrete Random Variable. Vector Random Variables, Joint D ac. in is tribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence. Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions. Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT - III

Random Processes – Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationary and Statistical Independence. First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationary, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

UNIT - IV

Random Processes – Spectral Characteristics: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

UNIT - V

Noise Sources & Information Theory: Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties. Entropy, Information rate, Source coding: Huffman coding, Shannon Fano coding, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade -off between Bandwidth and SNR.

TEXTBOOKS:

1 Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles, 4th Ed, TMH, 2001.
2 Taub and Schilling - Principles of Communication systems, TMH, 2008

REFERENCEBOOKS:

1 Bruce Hajck - Random Processes for Engineers, Cambridge unipress, 2015
2 Athanasios Papoulis and S. Unnikrishna Pillai - Probability, Random Variables and Stochastic Processes, 4 th Ed., PHI, 2002.
3 B.P. Lathi - Signals, Systems & Communications, B.S. Publications, 2003
4 S.P Eugene Xavier -Statistical Theory of Communication, New Age Publications, 2003

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- II Sem **L T P C**

3 0 0 3

(22EC402PC) ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

Course Objectives: Upon completing this course, the students will be able to

1 To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields, and apply them to solve physics and engineering problems.
2 To distinguish between static and time-varying fields, and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.
3 To study the propagation, reflection and transmission of plane waves inbounded and unbounded media.

Course Outcomes: Up on completing this course, the student able to

1 Apply the characteristics of basic laws of Electrostatics
2 Use Basic laws of Magneto statics
3 Distinguish Maxwell's equations for various boundary conditions
4 Analyze Uniform plane wave characteristics for several media.
5 Analyze transmission line parameters with different impedances

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2												
CO2	3	2												
CO3	3	3	1	1								1	1	2
CO4	3	3	1	1								1	1	2
CO5	3	3	1									1	1	2

UNIT – I Electrostatics

Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Energy Density. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors.

UNIT – II Magneto statics

Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law

UNIT – III Maxwell's Equations (Time Varying Fields)

Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Two Equations for Magnetostatic Fields, Maxwell's Two Equations for Electrostatic Fields Maxwell's Equations in Different Forms, Conditions at a Boundary Surface - Dielectric-Dielectric and Dielectric Conductor Interfaces.

UNIT – IV EM Wave Characteristics

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definitions, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem.

UNIT – V Transmission Lines

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Equivalent Circuit, Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless / Low Loss Characterization, Condition for Distortion less line, Minimum Attenuation, Loading - Types of Loading.SC and OC Lines, λ/4, λ/2, λ/8 Lines, Reflection Coefficient, VSWR Smith Chart – Configuration and Applications, Single Stub Matching.

TEXTBOOKS:

1 William H. Hayt Jr. and John A. Buck- Engineering Electromagnetic, 8 th Ed., cGrawHill,2014
2 Matthew N.O. sadiku and S.V. Kulkarni - Principles of Electromagnetic, 6th Ed.,Oxford University Press, Aisan Edition, 2015.

REFERENCEBOOKS:

1 JD. Kraus -Electromagnetic with Applications ,5th Ed., TMH
2 Umesh Sinha, Satya Prakashan -Transmission Lines and Networks, (Tech. India Publications), New Delhi, 2001
3 JD Ryder -Networks, Lines and Fields, 2 nd Ed., PHI, 1999

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- II Sem **L T P C**

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(22EC403PC) ANALOG AND DIGITAL COMMUNICATIONS

Prerequisite: Probability theory and Stochastic Processes, Signal and system

Course Objectives: The main objectives of the course are:

1 To introduce the basic building blocks of communication system
2 To teach the modulation and demodulation techniques
3 To introduce the individual blocks of transmitters & receivers
4 To introduce the digital communication and digital modulation methods
5 To teach the theory of baseband transmission and digital modulation techniques.

Course Outcomes: Up on completing this course, the student able to

1 Apply amplitude modulation and demodulation techniques in communication systems
2 Use the concepts of angle modulation in communication systems
3 Analyze working principle of analog transmitters and receivers
4 Summarize the different pulse code modulation techniques
5 Estimate probability of error for different digital modulation techniques

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	-	3	2	-	-	-	-	1	2	2
CO2	3	3	3	1	-	2	2	-	-	-	-	1	2	2
CO3	3	3	3	1	-	2	2	-	-	-	-	1	2	2
CO4	3	3	3	1	-	3	2	-	-	-	-	1	2	2
CO5	3	2	2	2	-	2	2	-	-	-	-	2	3	2

UNIT – I

Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.

UNIT – II

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave -Generation of FM Signal Armstrong Method, Detection of FM Signal: Balanced slope detector,

UNIT – III

Transmitters: Classification of Transmitters , AM Transmitters, FM Transmitters Receivers: Radio Receiver - Receiver Types - Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristic Frequency changing and tracking, Intermediate

frequency,Imagefrequency,AGC,Amplitudelimiting,FMReceiver,Comparison of AM and FM Receivers.

UNIT – IV

Pulse Modulation: Types of Pulse modulation-PAM, PWM and PPM. Comparison of FDM and TDM. Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Commanding , DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

UNIT – V

Digital Modulation Techniques: ASK- Modulator, Coherent ASK Detector, FSK- Modulator, Non Coherent FSK Detector, BPSK Modulator, And Coherent BPSK Detection. Principles of QPSK, Differential PSK and QAM. Baseband Transmission and Optimal Reception of Digital Signal: A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams.

TEXTBOOKS:

1 Simon Haykin-Analog and Digital Communications, JohnWiley,2005.
2 WayneTomasi- Electronics Communication Systems Fundamentals through Advanced, 5thEd.,PHI,2009

REFERENCEBOOKS:

1 Herbert Taub, Donald LSchilling, Goutam Saha,-Principles of Communication Systems,3rdEd.,McGraw-Hill,2008
2 Dennis Roddy and John Coolean- Electronic Communications,4thEd.,PEA,2004
3 George Kennedy and Bernard Davis-Electronics &Communication System,TMH,2004
4 K. Sam Shanmugam- Analog and Digital Communication, Willey, 2005

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II Year B.Tech. ECE- II Sem	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(22EC404PC) LINEAR AND DIGITAL IC APPLICATIONS

Course Objectives: The main objectives of the course are:

1 The main objectives of the course are:
2 To introduce the basic building blocks of linear integrated circuits
3 To teach the linear and non - linear applications of operational amplifiers.
4 To introduce the theory and applications of analog multipliers and PLL
5 To teach the theory of ADC and DAC.
6 To understand and implement the working of basic digital circuits

Course Outcomes: Up on completing this course, the students will be able to

1 Apply the inverting, non-inverting and differential concepts of Op-Amp.
2 Demonstrate the applications of op- Amp, 555 timer and PLL.
3 Analyzes the operation of ADC and DAC.
4 Discuss the application of various digital logic families of combinational Logic ICs
5 Design the sequential logic circuits and architecture of memories

Course Outcomes	**PROGRAMME OUTCOMES**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										2	
CO2	3	2	2	1									3	2
CO3	3	2	1	1	1				1				2	
CO4	3	2	2	1	2				1					2
CO5	3	2	2		2				1					1

UNIT – I

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation-Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators Features of 723 Regulators, Three Terminal Voltage Regulators.

UNIT – II

Op-Amp, IC-555 & IC565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Saw tooth, Square Wave, IC555 Timer-Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL-Block Schematic, principle and Applications.

UNIT – III

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications

UNIT – IV

Combinational Logic ICs: Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders,

Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtract or, Magnitude Comparators

UNIT – V

Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXTBOOKS:

1 Ramakanth A. Gayakwad - Op-Amps & Linear ICs, PHI, 2003.
2 Floydand Jain- Digital Fundamentals, 8th Ed., PearsonEducation,2005.

REFERENCEBOOKS:

1 D. Roy Chowdhury – Linear Integrated Circuits, New Age International(p)Ltd,2nd Ed., 2003.
2 John. F. Wakerly – Digital Design Principles and Practices, 3rdEd., Pearson, ,2009.
3 Salivahana -Linear Integrated Circuits and Applications, TMH, 2008.
4 William D.Stanley- Operational Amplifiers with Linear Integrated Circuits, 4thEd., Pearson Education India, 2009.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- II Sem

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3	0	0	3

(22EC405PC) ELECTRONIC CIRCUIT ANALYSIS

Pre-requisite: Analog Circuits

Course Objectives: Upon completing this course, the student twill be ablet

1 Learn the concepts of Power Amplifiers.
2 To give understanding of tuned amplifier circuits
3 Understand various multivibrators using transistors and sweep circuits

Course Outcomes: Up on completing this course, the students will be able to

1 Analyze the concepts of power amplifiers and determine its efficiency.
2 Analyze the tuned amplifiers to sketch the frequency response
3 Design Multivibrators for various applications.
4 Use sweep circuits in the concepts of synchronization and frequency division.
5 Analyze the PN Junction Diode as sampling gates.

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	1	1	-
CO3	3	2	3	-	-	-	-	-	-	-	-	1	1	-
CO4	3	3	2	-	-	-	-	-	-	-	-	1	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	1	-

UNIT – I Large Signal Amplifiers

Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class –C and D Amplifiers.

UNIT – II Tuned Amplifiers

Introduction, single Tuned Amplifiers – Q-factor, frequency response, Double Tuned Amplifiers – Q-factor, frequency response, Concept of stagger tuning and synchronous tuning.

UNIT – III Multivibrators

Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

UNIT – IV Time Base Generators

General features of a Time base Signal, Methods of Generating Time Base Waveform, concepts of Transistor Miller and Bootstrap Time Base Generator, Methods of Linearity improvement.

UNIT – V Synchronization and Frequency Division

Pulse Synchronization of Relaxation Devices, Frequency division in Sweep Circuits, Stability of Relaxation Devices, Astable Relaxation Circuits, Monostable Relaxation Circuits, Synchronization of a Sweep Circuit with Symmetrical Signals, Sine wave frequency division with a Sweep Circuit, A Sinusoidal Divider using Regeneration and Modulation. Sampling Gates: Basic operating principles of

Sampling Gates, Unidirectional and Bidirectional Sampling Gates, Four Diode Sampling Gate, Reduction of pedestal in Gate Circuits

TEXTBOOKS:

1 Jacob Millman, Christos C Halkias - Integrated Electronics, McGraw Hill Education
2 J. Millman, H. Taub and Mothiki S. PrakashRao - Pulse, Digital and Switching Waveforms –2 nd Ed., TMH, 2008,

REFERENCEBOOKS:

1 David A. Bell - Electronic Devices and Circuits, 5 thEd., Oxford.
2 Robert L. Boylestead, Louis Nashelsky - Electronic Devices and Circuits theory, 11th Ed.,Pearson, 2009
3 Ronald J. Tocci - Fundamentals of Pulse and Digital Circuits, 3rd Ed., 2008
4 David A. Bell - Pulse, Switching and Digital Circuits, 5 thEd., Oxford, 2015

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- II Sem **L T P C**

0 0 2 1

(22EC406PC) ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

Course Objectives: Students will be able to:

- Minimum 12 experiments should be conducted:
- All these experiments are to be simulated first either using MATLAB, COMSIM or any other simulation package and then to be realized in hardware

Course Outcomes: Up on completing this course, the student able to:

1 Apply the concepts of Modulation and Demodulation to a given signal.

2 Demonstrate the knowledge of Multiplexing and Demultiplexing in Communication System.

3 Analyze various Pulse Modulation techniques.

4 Examine Digital Modulation and Demodulation schemes

5 Evaluate the performance of Digital Communication system..

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	3	1	2	2	-	2	3	2	-	1		
CO2	1	-	3	1	2	2	-	2	3	2	-	1		
CO3	1	-	3	1	2	2	-	2	3	2	-	1		
CO4	1	-	3	1	2	2	-	2	3	2	-	1		
CO5	1	-	3	1	2	2	-	2	3	2	-	1		

List of Experiments:

1 (i) Amplitude modulation and demodulation (ii) Spectrum analysis of AM

2 (i) Frequency modulation and demodulation (ii) Spectrum analysis of FM

3 DSB-SC Modulator & Detector

4 SSB-SC Modulator & Detector (Phase Shift Method)

5 Frequency Division Multiplexing & De multiplexing

6 Pulse Amplitude Modulation & Demodulation

7 Pulse Width Modulation & Demodulation

8 Pulse Position Modulation & Demodulation

9 PCM Generation and Detection

10 Delta Modulation

11 DPCM Generation and Detection

12 Frequency Shift Keying: Generation and Detection

13 Binary Phase Shift Keying: Generation and Detection

14 Generation and Detection (i) DPSK (ii) QPSK

15 Generate FSK modulated signal using PLL

- ❖ Prove practically the Figure of Merit of DSB-SC is unity for single tone modulation

Major Equipment required for Laboratories:

1 CROs: 20MHz
2 Function Generators: 2MHz
3 Spectrum Analyzer
4 Regulated Power Supplies: 0-30V
5 MAT Lab/Equivalent Simulation Package with Communication tool box

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- II Sem **L T P C**

0 0 2 1

(22EC407PC) LINEAR AND DIGITAL IC APPLICATIONS LABORATORY

Course Outcomes: Up on completing this course, the student able to

1 Design and implementation of various analog circuits using 741 ICs.
2 Design and implementation of various Multivibrators using 555 timer
3 Design and implement ADC, DAC and voltage regulators
4 Designing and implement various combinational circuits using ICs
5 Designing and implement various sequential circuits using ICs

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			-	-	-	3	3	-	1		
CO2	3	2	2		1	-	-	-	3	3	-	1		
CO3	3	2	2	2	2	-	-	-	3	3	-	1	1	
CO4	3	2	1	2	2	-	-	-	3	3	1	1	1	
CO5	3	2	1	1	2	-	-	-	3	3	1	1	1	

Note:

- Minimum 12 experiments should be conducted
- Verify the functionality of the IC in the given application.

Design and Implementation of:

1 Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2 Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3 Design a Comparator using Op Amp and draw the comparison results of A=B, AB.
4 Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5 Design a Active LPF, HPF cutoff frequency of 2 KHZ and find the roll off of it
6 Design a Circuit using IC741 to generate sine/square/triangular wave with period of 1KHZ and draw the output waveform.
7 Construct Mono-stableMultivibratorusingIC555 and draw its output waveform.
8 Construct Astable Multivibrator using IC555 and draw its output waveform and also find its duty cycle.

9 Design a Schmitt Trigger Circuit and find its LTP and UTP.

10 Design Frequency modulator and demodulator circuit and draw the respective waveforms

11 Design VoltageRegulatorusingIC723, IC 7805/7809/7912 and find its load regulation factor.

12 Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.

13 Design Parallel comparator type/ counter type/ successive approximation ADC and find its efficiency.

14 Design a Gray code converter and verify its truth table.

15 Design an even priority encoder using IC 74xx and verify its truth table

16 Design a 8x1 multiplexer using digital ICs.

17 Design a 4-bit Adder/Subtract or using digital ICs and Add/Sub the following bits. (i)1010 0100 (ii)0101 0010 (iii)1011 1001

18 Design a Decade counter and verify its truth table and draw respective waveforms

19 Design a Up/down counter usingIC74163 and draw read/write waveforms

20 Design a Universal shift register using IC 74194/195 and verify its shifting operation

21 Design a 16x4 RAM using 74189 and draw its read/write operation.

22 Design a 8x3 encoder/3x8 decoder and verify its truth table

Major Equipment required for Laboratories:

1 5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply; Multimeter

2 20 MHz Oscilloscope with Dual Channel; Bread board and components/Trainer Kit;

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- II Sem **L T P C**

0 0 2 1

(22EC408PC) ELECTRONIC CIRCUIT ANALYSIS LABORATORY

Course Outcomes: Up on completing this course the students will be able to

1 Design power amplifiers and find its efficiency
2 Design tuned amplifiers and find its Q –factor.
3 Design various multivibrators and generate waveforms for different time periods.
4 Design various sweep circuits. Understand the necessity of linearity
5 Design sampling gates and understanding the concepts of frequency division.

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	9	-	-	1	1	-
CO2	3	2	3	-	-	-	-	-	9	-	-	1	1	-
CO3	3	2	3	-	-	-	-	-	9	-	-	1	1	-
CO4	3	2	2	-	-	-	-	-	9	-	-	1	1	-
CO5	3	2	2	-	-	-	-	-	9	-	-	1	1	-

List of Experiments (Twelve experiments to be done): Verify any twelve experiments in H/W Laboratory

1 Design transformer coupled class A power amplifier and draws the input and output waveforms find its efficiency.
2 Design class B power amplifier and draw the input and output waveforms, find 2nd order and above harmonics.
3 Prove that the complementary symmetry push pull amplifier eliminates cross over distortion.
4 Design class C power amplifier and draw the input and output waveforms.
5 Design a single tuned amplifier and determine the Q of its tuned circuit practically.
6 Design a Bi-stable Multivibrator and analyze the effect of commutating capacitors and draw the wave forms at base and collector of transistors.
7 Design an Astable Multivibrator and draw the wave forms at base and collector of transistors.
8 Design a Monostable Multivibrator and draw the input and output waveforms
9 Draw the response of Schmitt trigger for gain of greater than and less than one.
10 Design a Bootstrap sweep circuit using BJT and draw its output time base waveform
11 Design a Miller sweep circuit using BJT and draw its output time base waveform.
12 Design a constant current sweep generator and draw input and output waveforms
13 Design unidirectional and bidirectional sampling gates.

14 Prove practically Schmitt Trigger generates square wave.

15 Frequency division with sweep circuit.

Major Equipment required for Laboratories:

1 Regulated Power Suppliers, 0-30V
2 20 MHz, Dual Channel Cathode Ray Oscilloscopes
3 1 MHz Functions Generators-Sine and Square wave signals
4 Multimeters
5 Electronic devices

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

II Year B.Tech. ECE- II Sem	**L**	**T**	**P**	**C**
	0	**0**	**2**	**0**

(22MC409) GENDER SENSITIZATION LAB

COURSE DESCRIPTION

ThiscourseoffersanintroductiontoGenderStudies,aninterdisciplinary field that ask critical questions About the meanings of sex and gender in society. The primary goal of this course is to familiarize Students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies to examine cultural assumptions about sex, gender ,and sexuality

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmers combating gender based violence and discrimination.Thecoursealsofeaturesseveralexercisesandreflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact to gender-based violence one education, health and development.

Objectives of the Course

- To develop students' sensibility with regard to issues of gender in contemporary India
- To provide a critical per spective on the socialization of men and women.
- To in traduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence
- To expose students to more egalitarian an interactions between men and women

Learning Outcomes.

- Students will have developed a better understanding of important issues related to gender in contemporary India
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it**.**
- Students will acquire insight into the gendered division of labor and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals
- Students will develop sense of appreciation of women in all walks of life
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Course Outcomes	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3						1		
CO2						2			1			2		
CO3						2						3		
CO4						2						1		
CO5						2			2			2		
CO6						2			2			1		
CO7						1						2		

UNIT – I UNDERSTANDINGGENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men Preparing for Woman hood. Growing up Male. First lessons in Caste.

UNIT – II GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

UNIT – III GENDER AND LABOUR

Division and Valuation of Labor-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

UNIT – IV GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No!-Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu". Domestic Violence: Speaking Out Is Home a Safe Place? –When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

UNIT – V GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature-Gender Development Issues-Gender Issues- Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa ParksThe Brave Heart.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments

- **Classes will consist of a combination of activities:** dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".
- **ESSENTIAL READING:** The Textbook, "Towards a World of Equals: A Bilingual Textbook on Gender" written by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, GoguShyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

ASSESSMENT AND GRADING

Discussion & Classroom Participation: 20%

- Project/Assignment: 30%
- End Term Exam: 50%

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- I Sem

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(22EC501PC) MICROPROCESSORS AND MICROCONTROLLERS

Prerequisite: Nil

Course Objectives:

1. To familiarize the architecture of microprocessors and microcontrollers
2. To provide the knowledge about interfacing techniques of bus &memory.
3. To understand the concepts of ARM architecture
4. To learn the Interfacing 8051 Micro controller
5. To study the basic concepts of Advanced ARM processors

Course out comes: Up on completing this course ,the student will be able to

1. Use the concepts of internal architecture, organization and assembly language programming of 8086 processors.
2. Apply the internal architecture ,organization and assembly language programming of 8051 controllers
3. Differentiate the interfacing techniques 8086 and 8051 based systems.
4. Distinguish various instruction based on application.
5. Evaluate various Advanced ARM Processors in designing

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1				2	1					1	1	
CO2	3	2	2			2	2					2	2	2
CO3	3	3	3									2	2	1
CO4	3	2	2									2	2	2
CO5	3	2	1									1	2	1

UNIT - I

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Signal descriptions of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT -II

Introduction to Micro controllers: Overview of 8051Microcontroller, Architecture, Special function registers, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts.

UNIT - III

I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

UNIT – IV:

ARM Architecture: ARM Processor fundamentals, ARM Architecture–Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set –Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V:

Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:

1 A. K. Ray and K. M. Bhurchandani -Advanced Microprocessors and Peripherals, TMH, 2ndEdition 2006.

2 Andrew NSLOSS, Dominic SYMES,Chr is WRIGHT-ARM System Developers guide, Elsevier, 2012

REFERENCE BOOKS:

1 Kenneth .J.Ayala- The 8051 Micro controller, Cengage Learning, 3rd Ed, 2004.

2 D.V.Hall-MicroprocessorsandInterfacing, TMGH, 2nd Edition, 2006.

3 K.UmaRao, Andhe Pallavi-The 8051Microcontrollers, Architecture and Programming and Applications, Pearson, 2009.

4 Donald Reay-Digital Signal Processing and Applications with the OMAP- L138 Experimenter, WILEY 2012.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

(22EC502PC) CMOS VLSI DESIGN

Prerequisite: Electronic Circuit Analysis; Switching Theory and Logic Design

Course Objectives: The objectives of the course are to:

1. Give exposure to different steps involved in the fabrication of ICs.
2. Explain electrical properties of MOS and BiC MOS devices to analyze the behavior of inverters designed with various loads
3. Give exposure to the design rules to be followed to draw the layout of any logic circuit.
4. Provide design concepts to design building blocks of data path of any system using gates
5. Understand basic programmable logic devices and testing of CMOS circuits.

Course out comes: Up on completing this course ,the student will be able to

1. Understand the fabrication process of integrated circuits using MOS transistors.
2. Estimate parasitic effect of any logic circuit by drawing the layout
3. Analysis alternative circuits for area, capacitance and delay of gates
4. Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
5. Differentiate various types of faults in a system to improve its testability.

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1								1	2	
CO2	3	2	3	3	1								2	2
CO3	3	3	2	2	1							1	3	3
CO4	3	3	3	3								1	3	2
CO5	3	2	2	2	1								2	3

UNIT – I

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS &BiCMOS
Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters

UNIT - II

VLSI Circuit Design Processes: VLSI design flow - Floor planning and placement, Routing. MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT – III

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits,

Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out

UNIT - IV

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories, Content Addressable memory

UNIT - V

Programmable Logic Devices: Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs.

CMOS Testing: CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques, Built in self Repair(BISR).

TEXT BOOKS:

1 Essentials of VLSI circuits and systems – Kamran Eshraghian, EshraghianDougles and A. Pucknell, PHI, 2005 Edition.
2 CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009

REFERENCE BOOKS:

1 Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2 CMOS logic circuit Design - John. P. Uyemura, Springer, 2007.
3 Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997
4 VLSI Design- K. Lal Kishore, V. S. V. Prabhakar, I.K International, 2009.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- I Sem

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22EC503PC: CONTROL SYSTEMS

Prerequisite: Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

Course Objectives: The objectives of the course are to:

1 To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response

2 To assess the system performance using time domain analysis and methods for improving it

3 To assess the system performance using frequency domainanalys is and techniques for improving the performance

4 To design various controllers and compensators to improve system performance

Course out comes: Up on completing this course ,the student will be able to

CO1 Discuss the fundamentals of classical and modern control systems

CO2 Understand system representations like transfer function and state space, and assess system dynamic response

CO3 Evaluate system performance using both time and frequency domain analyses, identifying methods to enhance performance.

CO4 Design controllers and compensators to improve system performance based on the assessments from time and frequency domain analyses

CO5 Analyze the linear discrete time system in State space

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	1	1	1	1	1		1	1
CO2	3	3	3	2	2	2	1			1	2	1	1	1
CO3	3	2	2	2	1	1	1	1	1		1	1		
CO4	2	2	2	3	3	2	1			1	1	1	1	1
CO5	3	3	2	3	1	1	1	1		1	1	1		1

UNIT – I

Introduction to Control Problem: Industrial Control examples. Mathematical models of physical systems.Controlhardwareandtheirmodels.Transferfunctionmodelsoflineartime-invariantsystems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT -II

Time Response Analysis of Standard Test Signals: Time response of first and second order systems forstandardtestinputs.Applicationofinitialandfinalvaluetheorem.Designspecificationsforsecond- order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis.Root-Locus technique. Construction of Root-loci.

UNIT – III

Frequency-Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

UNIT – IV:

Introduction to Controller Design: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

UNIT – V:

State Variable Analysis and Concepts of State Variables: State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of control ability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

TEXT BOOKS:

1 M.Gopal,-Control Systems: Principles and Design, Mc Graw Hill Education, 1997.

2 B.C.Kuo,-Automatic ControlSystem, PrenticeHall,1995.

REFERENCE BOOKS:

1 K.Ogata=Modern Control Engineering, Prentice Hall,1991.

2 I.J.NagrathandM.Gopal-ControlSystemsEngineering,NewAgeInternational,2009.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- I Sem

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3	0	0	3

(22EC504PC) ANTENNAS AND WAVE PROPAGATION

Prerequisite: Electromagnetic Theory and Transmission Lines

Course Objectives: The course objectives are

1 To understand radiation, antenna parameters and to analyse thin wire dipole antennas
2 To identify antenna array requirements and characteristics of antenna arrays.
3 To understand the set-up requirements for microwave measurements
4 To analyse the characteristics of UHF, VHF and Microwave Antennas.
5 To distinguish between different phenomenon of wave propagations

Course out comes: Up on completing this course ,the student will be able to

1 Discover antennas based on frequency and establish radiation patterns of the antennas
2 Demonstrate antenna arrays and various antenna measurement methods
3 Explain the design consideration of VHF, UHF and microwave antennas
4 Evaluate the performance of Microstrip and Reflector antennas
5 Investigate mechanisms and characteristic features of different wave propagations

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2							3	3	3	3
CO2	3	3		2								2	2	
CO3	3	3	3	2							3	3	3	3
CO4	3	1	1								1	1	1	1
CO5	2		2	2							2		1	2

UNIT - I

Antenna Basics: Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height.
Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems
Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

UNIT –II

Antenna Arrays: Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays.
Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

UNIT -III

VHF, UHF and Microwave Antennas - I: Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

UNIT – IV:

VHF, UHF and Microwave Antennas - II: Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Micro strip Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

UNIT – V:

Wave Propagation - Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts,

Ground Wave Propagation –Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections.

Space Wave Propagation –Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation.

Sky Wave Propagation –Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation.

TEXT BOOKS:

1 J.D. Kraus,R.J. MarhefkaandAhmadS.Khan -Antennas and WavePropagation, 4th ed., (Special Indian Edition), TMH, New Delhi, 2010.

2 E.C.JordanandK.G.Balmain-ElectromagneticWavesandRadiatingSystems,PHI,2nded., 2000.

REFERENCE BOOKS:

1 C.A.Balanis-AntennaTheory, 3rdEdition. John Wiley&Sons,2005.

2 K.D. Prasad, Satya Prakashan - Antennas and Wave Propagation, Tech India Publications, New Delhi, 2001.

3 KeithhenneyRadioEngineeringHandbook, 3rdeditionTMH.

4 JohnLeonidasVolakis-AntennaEngineeringHandbook,3rdedition,2007

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC511PE: COMPUTER ORGANIZATION AND OPERATING SYSTEMS
Professional Elective – I

Course Objectives:

1 To understand the structure of a computer and its operations
2 To understand the RTL and Micro-level operations and control in a computer.
3 Understanding the concepts of I/O and memory organization and operating systems.

Course out comes: Up on completing this course ,the student will be able to

1 Visualize the organization of different blocks in a computer
2 Utilize the micro-level operations to control different units in a computer.
3 Understand various Peripheral and I/O interfaces which can be connected to Computer
4 Knowing the Operating systems basic concepts and services
5 Implement Operating systems file system in a computer.

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	1				1		2	1		
CO2	1	1	3	3	2				2		1	2		
CO3	2	1	1	2	1				2		1	3		
CO4	2	1	2	2	2				2		2	1		
CO5	2	1	1	3	1				2		1	2		

UNIT - I

Basic Structure of Computers: Computer Types, Functional Unit, Basic operational Concepts Bus Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating–Point Representation.

Register Transfer Language and Micro Operations : Register Transfer Language, Register Transfer BusandMemoryTransfers,ArithmeticMicroOperations,LogicMicroOperations,ShiftMicro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions –Instruction Cycle, Memory–Reference Instructions ,Input–Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

UNIT -II

Micro Programmed Control : Control Memory, Address Sequencing, Micro program Examples, Design of Control Unit, Hard Wired Control, Micro programmed Control

The Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories Secondary Storage, Introduction to RAID.

UNIT - III

Input-Output Organization: Peripheral Devices, Input- Output interface ,Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input –Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE 1394.

UNIT – IV:

Operating Systems Overview: Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating Systems Generation

Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of The Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows

Principles of Deadlock: System Model, Dead lock Characterization, Dead lock Prevention, Detection and Avoidance, Recovery from Deadlock.

UNIT – V:

File System Interface: The Concep to faFile, Access Methods, Directory Structure, File System Mounting, File Sharing, and Protection.

File System Implementation: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

TEXT BOOKS:

1 Carl Hamacher, Zvonks Vranesic, Safea Zaky - Computer Organization, 5th Edition, McGraw Hill.

2 M. Moris Mano -Computer Systems Architecture, 3rd Edition, Pearson

3 Abraham Silberchatz, Peter B. Galvin, Greg Gagne -Operating System Concepts, 8th Edition, John Wiley.

REFERENCE BOOKS:

1 William Stallings- Computer Organization and Architecture, 6th Edition, Pearson

2 Andrew S. Tanenbaum -Structured Computer Organization, 4th Edition, PHI

3 Sivaraama Dandamudi - Fundamentals of Computer Organization and Design, Springer Int. Edition

4 Stallings -Operating Systems – Internals and Design Principles, 6th Edition, Pearson Education, 2009.

5 Modern Operating Systems, Andrew S Tanenbaum 2nd Edition, PHI.

6 Principles of Operating Systems, B.L. Stuart, Cengage Learning, India Edition

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III Year B.Tech. ECE- I Sem

L	T	P	C
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22EC512PE: NETWORK SECURITY AND CRYPTOGRAPHY
Professional Elective – I

Prerequisite: Nil

Course Objectives:

1 Understand the basic concept of Cryptography and Network Security, their mathematical models
2 To understand the necessity of network security, threats/vulnerabilities to networks and countermeasures
3 To understand Authentication functions with Message Authentication Codes and Hash Functions.
4 To provide familiarity in Intrusion detection and Firewall Design Principles

Course out comes: Up on completing this course ,the student will be able to

1 Describe network security fundamental concepts and principles
2 Encrypt and decrypt messages using block ciphers and network security technology and protocols
3 Analyze key agreement algorithms to identify their weaknesses
4 Able to understand current legal issues towards information security
5 Identify and assess different types of threats, malware, spyware, viruses, vulnerabilities

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	1	1				2		
CO2	3	3	3	3	2	3				1		2		
CO3	2	3	3	2	3	3	1	1		1		1		
CO4	3	3	3	2	1	2	2					2		
CO5	2	3	1	3	1	3	2	1		3	1	3		

UNIT - I

Security Services, Mechanisms and Attacks, A Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.
Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

UNIT -II

Encryption: Triple DES, International Data Encryption algorithm, Blowfish, RC5, Characteristics of Advanced Symmetric block Ciphers. Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation

UNIT - III

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.
Number Theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms

UNIT – IV:

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.
Hash and Mac Algorithms: MD-5, Message digest Algorithm, Secure Hash Algorithm.
Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.
Authentication Applications: Kerberos, Electronic Mail Security: Pretty Good Privacy, SIME/MIME

UNIT – V:

IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.
Intruders, Viruses and Worms: Intruders, Viruses and Related threats.
Fire Walls: Fire wall Design Principles, Trusted systems

TEXT BOOKS:

1 William Stallings-Cryptography and Network Security: Principles and Practice, Pearson Education
2 Robert Bragg, Mark Rhodes -Network Security: The complete reference, TMH, 2004.

REFERENCE BOOKS:

1 William Stallings - Network Security Essentials (Applications and Standards), Pearson Education
2 Eric Maiwald - Fundamentals of Network Security, Dreamtech press
3 Whitman - Principles of Information Security, Thomson
4 Buchmann - Introduction to Cryptography, Springer.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC513PE: ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
Professional Elective – I

Prerequisite: Basic Electrical and Electronics Engineering

Course Objectives:

1 It provides an understanding of various measuring system functioning and metrics for performance analysis.

2 Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment

3 Understanding the concepts of various measuring bridges and their balancing conditions.

4 Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course out comes: Up on completing this course ,the student will be able to

1 Use the concepts of Performance Characteristics in measuring various physical quantities

2 Apply the concepts of signal generators, signal analyzers for generating and analyzing various real-time signals.

3 Analyze the use of Oscilloscope to measure various signals.

4 Describe the working principle, selection criteria and applications of various transducers used in measurement systems.

5 Design various Bridges for measuring Physical Parameters

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	1	-	-	1	-	3	3	2
CO2	2	3	1	1	-	-	1	-	-	1	-	3	3	2
CO3	2	3	1	1	-	-	1	-	-	1	-	3	3	2
CO4	3	3	1	1	-	-	1	-	-	1	-	3	3	2
CO5	3	3	2	3	-	-	1	-	3	3	-	3	3	3

UNIT - I

Block Schematics of Measuring Systems: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Millimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT -II

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

UNIT - III

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.
Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs

UNIT – IV:

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

UNIT – V:

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.
Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure — High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

TEXT BOOKS:

1 Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W. D. Cooper: PHI 5th Edition 2003.
2 Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

REFERENCE BOOKS:

1 Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.
2 Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
3 Industrial Instrumentation: T.R. Padmanabham Springer 2009.
4 Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- I Sem **L T P C**

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22EC505PC: MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

Course out comes: Up on completing this course ,the student will be able to

1 Develop assembly language programming using 8086 instructions.

2 Develop assembly language programming using 8051 instructions.

3 Analyze the delay using timers of 8051.

4 Evaluate the concept of serial communication using 8051.

5 Analyze I/O interfacing techniques on 8051 microcontroller based systems

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			2	1					1	3	2
CO2	3	3	2			2	2					2	3	2
CO3	3	3	1		2							2	2	1
CO4	3	3	2	2	2							2	3	3
CO5	3	2	1									1	2	2

Cycle 1: Using 8086 Processor Kits and/or Assembler

Assembly Language Programs to 8086 to Perform

1 Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.

2 Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations

Cycle 2: Using 8051 Microcontroller Kit

Introduction to IDE

1 Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions

2 Time delay Generation Using Timers of 8051.

3 Serial Communication from / to 8051 to / from I/O devices.

4 Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

Cycle 3: Interfacing I/O Devices to 8051

1 7 Segment Display to 8051.

2 Matrix Keypad to 8051.

3 Sequence Generator Using Serial Interface in 8051.

4 8-bit ADC Interface to 8051.

5 Triangular Wave Generator through DAC interfaces to 8051.

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III Year B.Tech. ECE- I Sem

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22EC506PC: CMOS VLSI DESIGN LABORATORY

Course Objectives: The objectives of the course are:

1 To learn the HDL programming language.
2 To learn the simulation of basic gates using the HDL.
3 To learn the simulation of combinational and sequential circuits using HDL.
4 To learn the synthesis and layouts of analog and digital CMO Scircuits.
5 To develop an ability to simulate and synthesize various digital circuits.

Course Outcomes: Up on completing this course ,the student will be able to

1 Simulate various digital circuits.
2 Develop an ability of designing of analog and digital CMOS circuits.
3 Design Entry & simulation of combinational and sequential circuits with test bench &
4 Develop a configuration/fuse files for combinational and sequential circuits & implementation of the hardware using FPGA.
5 Design a schematic and simple layout for CMOS circuits

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1											3	
CO2	3	1											3	
CO3	3	3	1	1									3	
CO4	3	3	3	3									3	2
CO5	3	3	3	3	2							1	3	2

All the following experiments have to be implemented using HDL

1 Realize all the logic gates
2 Design of 8-to- 3 encoder(without and with priority)and 2-to-4 decoder
3 Design of 8-to-1multiplexer and 1-to-8 de multiplexer
4 Design of 4bit binary to gray code converter
5 Design of 4bit comparator
6 Design of Fulladder using 3modeling styles
7 Design of flip flops: SR, D,JK,T
8 Design of Latch
9 Design of 4- bit binary ,BCD counters (synchronous/asynchronous reset)or any equence counter
10 Design of 4-bit Parity Generator.
11 Finite State Machine Design
12 Design and implementation of Arithmetic Logic Unit
13 Design of zero detector
14 Design and Implementation of Shift Register

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III Year B.Tech. ECE- I Sem

L	T	P	C
0	0	2	1

22EC507PC: ADVANCED COMMUNICATIONS LABORATORY

Course Objectives: The objectives of the course are:

1 To study the antennas based on the requirement of the application using Practical Antenna.

2 To understand the measurement of antenna parameters.

3 To understand different High frequency antennas and its radiation pattern.

4 To design and analyse different parameters of an antenna based on the radiation characteristics.

5 To design and implement antennas using EM simulation tools.

Course Outcomes: Up on completing this course ,the student will be able to

1 Illustrate the different ways of measuring antenna parameters.

2 Differentiate the different Radiation pattern of the antennas

3 Study the characteristics of Antennas

4 Articulate the performance of Antennas based on the measurements

5 Formulate an antenna design using Antenna technologies.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1						3	3	3	3
CO2	3	3	3	2	2						2	2	3	2
CO3	2	2	1	2							1	1	3	2
CO4	3	2	2	2	1						1	1	2	1
CO5	3	2	2	2	1						2	2	2	1

Note: Minimum Eight experiments should be conducted:

1 Study the features of spectrum analyzer

2 Simulate the Radiation pattern for different antennas using Matlab/4NEC2 (open source)
   a. Dipole Antenna
   b. Horn antenna
   C. Micro strip Antenna etc.

3 Simulate the Radiation resistance for different antennas using MATLAB/ 4NEC2 (open source)
   a. Dipole Antenna
   b. Horn antenna
   c. Micro strip Antenna etc.

4 Measurement of Radiation Pattern and gain of monopole Antenna

5 Measurement of Radiation Pattern and gain of loop Antenna

6 Measurement of Radiation Pattern and gain of Helical Antenna

7 Measurement of Radiation Pattern and gain of Antenna Array

8 Measurement of Radiation Pattern and gain of Yagi-Uda Antenna

9 Measurement of Radiation Pattern and gain of Folded Dipole Antenna

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III Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	0

22MC510: INTELLECTUAL PROPERTY RIGHTS

Course Objectives:

1 To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2 To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
3 To disseminate knowledge on copyrights and its related rights and registration aspects
4 To disseminate knowledge on trademarks and registration

Course Outcomes: Up on completing this course ,the student will be able to

1 Use intellectual property by interpreting various rights ensured by IPR to the intellectuals
2 Demonstrate various processes involved in acquiring trademarks.
3 Distinguish the features of copyrights and patterns.
4 Explain the laws and the extent they protect trade secrets.
5 Analyze new developments of intellectual property

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					2			1					
CO2	3					2							1	
CO3	2	1	1		2				1				2	1
CO4		2				2		2	1			3	2	2
CO5	3	1	1						2				2	2

UNIT - I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT -II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes

UNIT - III

Law of copyrights: Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, and notice of copyright, International copyright law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV:

Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V:

New development of intellectual property: new developments in trade mark law; copyright law, patent law, intellectual property audits.
International overview on intellectual property, international — trade mark law, copyright law, international patent law, and international development in trade secrets law.

TEXT BOOKS:

1 Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

REFERENCE BOOKS:

1 Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

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III Year B.Tech. ECE- II Sem

L	T	P	C
3	0	0	3

22EC601PC: DIGITAL SIGNAL PROCESSING

Prerequisites: Signals and Systems

Course Objectives: The course objectives are

- To provide background and fundamental material for the analysis and processing of digital signals.
- To understand the fast computation of DFT and appreciate the FFT processing.
- To study the designs and structures of digital (IIR and FIR) filters and analyse and synthesize for a given specifications
- To acquaint in Multi-rate signal processing techniques and finite word length effects

Course Outcomes: Up on completing this course ,the student will be able to

1 Appeal the concepts of linear difference equations and Multi-rate digital signal processing on DTS
2 Employ DFT and FFT concepts to obtain frequency domain characteristics of DTS.
3 Analyze digital IIR filters by suitable design procedures.
4 Evaluate digital FIR filters by suitable design procedures
5 Forming of Realization structures and discusses finite word length effects.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			2	1					1	2	2
CO2	3	2	2									2		2
CO3	3	3	3	1										3
CO4	3	3	2											2
CO5	3	3	3	2								1	2	3

UNIT - I

Introduction: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency**,** Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation**,** Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems **Multirate Digital Signal Processing:** Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion

UNIT -II

Discrete Fourier series: Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation**,** DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z- Transform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

UNIT - III

IIR Digital Filters: Analog filter approximations — Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations

UNIT – IV:

FIR Digital Filters: Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters

UNIT – V:

Realization of Digital Filters: Applications of Z — Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters — Direct, Canonic, Cascade and Parallel Forms.

Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects

TEXT BOOKS:

1 A. V. Oppenheim and R.W. Schaffer - Discrete Time Signal Processing, PHI, 2009

2 John G. Proakis, Dimitris G. Manolakis - Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education / PHI, 2007.

REFERENCE BOOKS:

1 Li Tan - Digital Signal Processing – Fundamentals and Applications, Elsevier, 2008

2 Robert J. Schilling, Sandra L. Harris - Fundamentals of Digital Signal Processing.

3 S. Salivahanan, A. Vallavaraj and C. Gnanapriya - Digital Signal Processing, TMH, 2009

4 Emmanuel C. Ifeachor and Barrie W. Jervis - Digital Signal Processing - A

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- II Sem

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22EC602PC: IoT ARCHITECTURES AND PROTOCOLS

Prerequisites: Nil

Course Objectives:

1. To provide the basic knowledge on IoT.
2. To explain the different components and Architectures from M2M to IoT.
3. To provide knowledge on different protocols of IoT.
4. To impart knowledge on implementations of different protocols of IoT

Course Outcomes: Up on completing this course ,the student will be able to

1. Explore the Evolution of IoT, its Growth and Applications.
2. Know the components of IoT and Compare the various architectures of IoT.
3. Acquire the knowledge on data management of IoT.
4. Establish the knowledge on various IoT protocols like Data link, Network, Transport, Session, Service layers
5. Design various Security routing protocols for various applications.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2	2	1					2	2	2
CO2	3	3			2							2	2	2
CO3	3	3			2	2	1					2	2	2
CO4	3	3			2							2	2	2
CO5	3	3	3		2	2	1					2	2	2

UNIT - I

IoT introduction:

Introduction and definition of IoT, Evolution of IoT, IoT growth, Application areas of IoT, Characteristics of IoT, IoT stack, Enabling technologies, IoT levels, IoT sensing and actuation, Sensing types, Actuator types

UNIT -II

IoT and M2M:

M2M to IoT — A Basic Perspective– Introduction, Differences and similarities between M2M and IoT, SDN and NFV for IoT,M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, international driven global value chain and global information monopolies.

IoT Architecture:

IoT Architecture components, Comparing IoT Architectures, A simplified IoT Architecture, core IoT functional stack, IoT data management and compute stack

UNIT - III

IoT Data link layer and Network layer protocols:

PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP

UNIT – IV:

Transport and Session layer protocols:

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) — Session Layer HTTP, CoAP, XMPP, AMQP, MQTT

UNIT – V:

Service layer protocols and Security:

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 6LoWPAN, RPL, and Application Layer.

TEXT BOOKS:

1 A Sudip Misra, Anandarup Mukherjee, Arijit Roy -Introduction to IOT, Cambridge University Press

2 David Hanes, Gonzalo salgueiro, Patrick Grossetete, Rob barton, Jerome henry-IoT Fundamentals Networking Technologies, Protocols and Usecases for IoT", Cisco Press.

REFERENCE BOOKS:

1 Cunopfister-Getting started with the internet of things, O Reilly Media, 2011

2 Francis daCosta,-Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.

3 Arshdeep Bahga, Vijay Madisetti -Internet of Things A Hands-on approach, Universities Press

4 Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan-Internet of things, John Wiley and Sons.

5 Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers

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III Year B.Tech. ECE- II Sem

L	T	P	C
3	0	0	3

22HS601MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

Prerequisites: Nil

Course Objectives:

1 To learn the basic business types, impact of the economy on Business and Firms specifically

2 To analyze the Business from the Financial Perspective.

Course Outcomes: Up on completing this course ,the student will be able to

1 The students will understand the various Forms of Business

2 The Demand, Supply aspects are learnt

3 Production, Cost, Market Structure, Pricing aspects are learnt.

4 The Students can learn to analyze the Financial Statements of a Company

5 Select the appropriate method to calculate analysis of different ratios

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	3	-	2	-	3	-	-	-
CO2	-	-	-	-	-	1	3	-	2	1	3	-	-	-
CO3	-	-	-	-	-	1	3	-	2	1	3	-	-	-
CO4	-	-	-	-	-	1	3	-	-	-	3	-	-	-
CO5	-	-	-	-	-	2	3	2	-	--	3	-	-	-

UNIT - I

Introduction to Business and Economics:

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT -II

Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT - III

Production, Cost, Market Structures & Pricing:
Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition.
Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT – IV:

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts

UNIT – V:

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1 D.D. Chaturvedi, S.L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.

2 Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011

3 Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.

REFERENCE BOOKS:

1 Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.

2 S.N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- II Sem

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22EC621PE: DATA COMMUNICATIONS AND COMPUTER NETWORKS
Professional Elective – II

Course Objectives:

1 To introduce the Fundamentals of data communication networks
2 To demonstrate the Functions of various protocols of Data link layer.
3 To demonstrate Functioning of various Routing protocols.
4 To introduce the Functions of various Transport layer protocols.
5 To understand the significance of application layer protocols

Course Outcomes: Up on completing this course ,the student will be able to

1 Demonstrate network models, network types and transmission media.
2 Illustrate Data link layer Protocols
3 Compare the Virtual Vs datagram networks
4 Determine the connection oriented, connectionless and web application services
5 Design wireless network using IEEE standards

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						-	-		1		
CO2	3	3	2						-	-		1		
CO3	3	3	3	1					-	-				
CO4	3	3	3	1					-	-		1	1	2
CO5	3	3	3	2					-	-		1	1	2

UNIT - I

Introduction to Data Communications: Components, Data Representation, Data Flow, Networks- Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards

- Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing.

UNIT - II

Data Link Layer: Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols.

UNIT - III

The Network Layer: Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol (IP):Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6

UNIT - IV

Transport Layer: Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and De multiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go- Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control

UNIT - V

Application Layer: Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet-STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

TEXT BOOKS:

1 Kurose James F, Keith W- Computer Networking A Top-Down Approach, 6th Edition, Pearson.

2 Behrouz A. Forouzan - Data Communications and Networking, 4th Edition, McGraw-Hill Education

REFERENCE BOOKS:

1 Bhusan Trivedi - Data communication and Networks, Oxford university press, 2016

2 Andrew S Tanenbaum - Computer Networks, 4th Edition, Pearson Education

3 W. A. Shay - Understanding Communications and Networks, 3rd Edition, Cengage Learning.

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III Year B.Tech. ECE- II Sem

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22EC622PE: EMBEDDED SYSTEM DESIGN
Professional Elective – II

Prerequisite: Microprocessors and Microcontrollers; Computer Organization and Operating Systems

Course Objectives: The course objectives are

1 To provide an overview of Design Principles of Embedded System
2 To understand the necessity of operating systems in correlation with hardware systems.
3 To provide clear understanding about the role of firmware
4 To learn the methods of Interfacing and synchronization for tasking.
5 To learn case studies on embedded system design application.

Course Outcomes: Up on completing this course ,the student will be able to

1 Apply the knowledge of attributes for the selection of Embedded System in given application area
2 Analyze the types of memory and interfacing to external hardware.
3 Design procedure for Embedded Firmware
4 Visualize the role of Real time Operating Systems in Embedded Systems.
5 Evaluate Various case studies for different applications

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	2	2	-	-	2	2	2	3	3
CO2	3	3	2	2	3	2	2	-	-	2	2	2	3	3
CO3	3	3	2	2	3	3	3	-	-	3	3	3	2	2
CO4	3	3	2	2	2	3	2	-	-	2	2	2	2	2
CO5	3	3	2	2	2	2	3	-	-	3	3	3	3	3

UNIT - I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT - II

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT - III

Embedded Firmware: Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches, Development Languages and Embedded C programming.

UNIT - IV

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets

Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

UNIT - V

Embedded System Application and Development: case study of washing machine, battery Operated smart card reader, automatic vending machine and automated meter reading system.

TEXT BOOKS:

1 Shibu K.V - Introduction to Embedded Systems, Mc Graw Hill.

REFERENCE BOOKS:

1 Raj Kamal - Embedded Systems, TMH
2 Frank Vahid, Tony Givargis - Embedded System Design, John Wiley
3 Lyla - Embedded Systems, Pearson, 2013
4 David E. Simon - An Embedded Software Primer, Pearson Education.

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III Year B.Tech. ECE- II Sem

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22EC623PE: ARTIFICIAL NEURAL NETWORKS
Professional Elective – II

Prerequisite: N i l

Course Objectives: The course objectives are

1 To understand the biological neural network and to model equivalent neuron models.
2 To understand the architecture, learning algorithms
3 To know the issues of various feed forward and feedback neural networks
4 To explore the Neuro dynamic models for various problems.

Course Outcomes: Up on completing this course ,the student will be able to

1 Explore the similarity of Biological networks and Artificial Neural networks
2 Perform the training of neural networks using various learning rules.
3 Understand the concept of back propagation networks
4 Explaining the concept self-organizing feature maps
5 Construct the Neuro Dynamic models for various problems

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	3	2						1	1	1
CO2	3	1	1	1	3	1						2	2	2
CO3	3	1	2	2	3	1						2	1	1
CO4	2	1	2	1	2	1						2	1	1
CO5	3	1	2	2	2	1						2	2	2

UNIT – I

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT – II

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT - III

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT - IV

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT - V

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm

Hopfield Models – Hopfield Models, restricted boltzmen machine

TEXT BOOKS:

1 Simon S Haykin - Neural Networks a Comprehensive Foundations, PHI

2 Jacek M. Zurada - Introduction to Artificial Neural Systems, JAICO Publishing

REFERENCE BOOKS:

1 Li Min Fu - Neural Networks in Computer Intelligence, TMH 2003

2 James A Freeman David M S Kapura - Neural Networks, Pearson, 2004.

3 B. Vegnanarayana -Artificial Neural Networks, Prentice Hall of India P Ltd, 2005

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III Year B.Tech. ECE- II Sem

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22EC603PC: DIGITAL SIGNAL PROCESSING LABORATORY

The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

Note: - Minimum of 12 experiments has to be conducted.

Course Objectives: The course objectives are

1. To impart background and fundamental material for the analysis and processing of signals.
2. To realize the fast computation of DFT and appreciate the FFT processin
3. To inquiry the designs and structures of digital filters and analyzefor a given specifications
4. To accustom Multi-rate signal processing techniques and finite word length effects.

Course outcomes: Up on completing this course ,the student will be able to

1. Apply DFT and frequency response for given discrete time signal
2. Analyze FFT and its computation complexity in comparison to DFT for given input sequence
3. Analyze the concept of IIR digital filters
4. Evaluate the concept of FIR digital filters.
5. Evaluate response of multi-rate signal processing for suitable desired specifications

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2	2	2					2	2	2
CO2	3	3			2							2	2	2
CO3	3	3			2	2	2					2	2	2
CO4	3	3			2							2	2	2
CO5	3	3	3		2	2	2					2	2	2

List of Experiments:

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. Histogram of White Gaussian Noise and Uniformly Distributed Noise
3. To find DFT / IDFT of given DT Signal
4. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
6. Implementation of FFT of given Sequence
7. Determination of Power Spectrum of a given Signal(s).
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Generation of Narrow Band Signal through Filtering
11. Generation of DTMF Signals

12 Implementation of Decimation Process
13 Implementation of Interpolation Process
14 Implementation of I/D Sampling Rate Converters
15 Impulse Response of First order and Second Order Systems.

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III Year B.Tech. ECE- II Sem

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0	0	2	1

22EC604PC: IoT ARCHITECTURE AND PROTOCOLS LABORATORY

Course Outcomes: Up on completing this course the students will be able to:

1 Utilize the different sensors like room temperature, DHT, Humidity etc.,
2 Interface the sensors and processor for transmission of data
3 Capture the images and process it on Arduino/NodeMCU/Raspberry Pi
4 know the utilization of various protocols like I2c, UART communication etc.,
5 Design protocols for various applications

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2	2	1					2	2	2
CO2	3	3			2							2	2	2
CO3	3	3			2	2	1					2	2	2
CO4	3	3			2							2	2	2
CO5	3	3	3		2	2	1					2	2	2

List of Experiments:

1 Demonstrate blinking of an LED at every 5 seconds and to control the brightness of an LED.
2 Read Humidity and Room Temperature using DHT sensor and display the readings.
3 Send the recorded values of Temperature/Humidity to the Internet via GSM module using Arduino/NodeMCU/Raspberry Pi.
4 Demonstrate Interfacing NodeMCU/Raspberry Pi with the Cloud using REST API and MQTT protocol.
5 Demonstrate Switching lights on /off remotely using Arduino/NodeMCU/Raspberry Pi
6 Voice-based Home Automation for switching lights on/off using Google Assistant, IFTTT and MQTT
7 Interfacing DHT11 sensor with Raspberry pi/equivalent and upload temperature and humidity values to the cloud
8 Design an obstacle detection unit using ultrasonic sensor
9 Capture images from web camera using Raspberry Pi/equivalent and apply filters in increase image quality.
10 Access a remote computer from Raspberry Pi and display the remote screen.
11 Design an automatic water sprinkler based on soil moisture using Arduino/NodeMCU/Raspberry Pi
12 Design an RFID based attendance system using Arduino/NodeMCU/Raspberry Pi
13 Write an arduino program to demonstrate interrupts
14 Write an arduino program to demonstrate UART communication protocol
15 Write an arduino program to demonstrate I2C communication protocol
16 Write an arduino program to demonstrate SPI communication protocol

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III Year B.Tech. ECE- II Sem	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

22EN601HS: ADVANCED ENGLISH COMMUNICATION SKILLS LABORATOR

Introduction

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech 3rd year level. At this stage, the students need to prepare themselves for their career which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use appropriate English and perform the following:

1 Gathering ideas and information to organise ideas relevantly and coherently
2 Making oral presentations.
3 Writing formal letters
4 Transferring information from non-verbal to verbal texts and vice-versa
5 Writing project/research reports/technical reports
6 Participating in group discussions.
7 Engaging in debates.
8 Facing interviews
9 Taking part in social and professional communication

Objectives :

This Lab focuses on using multi-media instruction for language development to meet the following targets:

1 To improve the students' fluency in English, with a focus on vocabulary
2 To enable them to listen to English spoken at normal conversational speed by educated English speakers
3 To respond appropriately in different socio-cultural and professional contexts
4 To communicate their ideas relevantly and coherently in writing

Course Outcomes: Upon completing this course the students will be able to:

1 The student should be able to:
2 Develop Listening and Reading skills, with a focus on vocabulary
3 Build written communication skills to meet the needs of their academic and career endeavors.
4 Choose appropriate language in their oral communications in various social and professional contexts.
5 Demonstrate the nuances of language and body language through group activities.
6 Take part in interviews with confidence thereby enhancing their employability skills.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1	2			3	3	2			1	1		
CO2						1	3	2				1		
CO3		2	3			2	2	2				1		
CO4		1	1			3	3	2			1	2		
CO5						2	2	3				2		

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1 Activities on Listening and Reading Comprehension: Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Sub-skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading — Reading Comprehension – Exercises for Practice.

2 Activities on Writing Skills: Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills -Structure and presentation of different types of writing– Free Writing and Structured Writing -Letter Writing –Writing a Letter of Application – Resume vs. Curriculum Vitae – Writing a Résumé **–** Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette –Report Writing – Importance of Reports – Types and Formats of Reports–Technical Report Writing– Exercises for Practice

3 Activities on Presentation Skills - Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions-PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Gloss phobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation

4 **Activities on Group Discussion (GD):**Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas **–** Do's and Don'ts - GD Strategies – Exercises for Practice

5 **Interview Skills**: Concept and Process -Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference &Video-conference - Mock Interviews

Books Recommended:

1 Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2nd ed.). McGraw Hill Education (India) Pvt. Ltd.

2 Suresh Kumar, E. (2015). *Engineering English.* Orient BlackSwan Pvt. Ltd

3 Bailey, Stephen. (2018). Academic *Writing: A Handbook for International Students.* (5th Edition). Routledge.

4 Koneru, Aruna. (2016). *Professional Communication*. McGraw Hill Education (India) Pvt. Ltd.

5 Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication, 3E: Principles and Practice.* Oxford University Press

6 Anderson,Paul V. (2007). *Technical Communication***.** Cengage Learning Pvt. Ltd. New Delhi.

7 McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). *English Vocabulary in Use* Series. Cambridge University Press

8 Sen, Leela. (2009). *Communication Skills.* PHI Learning Pvt Ltd., New Delhi.

9 Elbow, Peter. (1998). *Writing with Power*. OxfordUniversity Press

10 Goleman, Daniel. (2013).EmotionalIntelligence: Why it can matter more than IQ. Bloomsbury Publishing.

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III Year B.Tech. ECE- II Sem

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22MC610: ENVIRONMENTAL SCIENCE

Course Outcomes: Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development.

The students should be able to:

1 Know basic concept of ecological perspective and the value of the environment.
2 Underst and the significance of various natural resources and its management
3 Demonstrate a comprehensive understanding of the world's biodiversity and the importance of its conservation.
4 Identify different types of pollution and their control measures, Discovereffective methods of waste management and come out with best possible solutions
5 Raise awareness about environmental laws and sustainable development

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1	2			3	3	2			1	1		
CO2						1	3	2				1		
CO3		2	3			2	2	2				1		
CO4		1	1			3	3	2			1	2		
CO5						2	2	3				2		

UNIT - I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnifications, ecosystem value, services and carrying capacity, Field visits.

UNIT - II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT - III

Biodiversity and BIoTic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In- Situ and Ex-situ conservation. National Biodiversity act

UNIT - IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water

quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS).Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives

UNIT - V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Over view on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for UniversityGrants Commission

2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1 Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.

2 Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd

3 Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.

4 Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers

5 Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BSPublications

6 Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

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III Year B.Tech. ECE- II Sem

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22EC611OE: FUNDAMENTALS OF INTERNET OF THINGS
Open Elective-I

Course Objectives: The objectives of the course are to:
1. Make concepts of Internet of Things understandable to build IoT applications
2. Teach the programming and use of Arduino and Raspberry Pi boards
3. Provide Knowledge about data handling and analytics in SDN.

Course Outcomes: Up on completing this course, the students will be able to.
1. Know basic protocols in sensor networks.
2. Program and configure Arduino boards for various designs
3. Python programming and interfacing for Raspberry Pi.
4. Analyze Software defined Network for IoT
5. Design IoT applications in different domains.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1	2			3	3	2			1	1		
CO2						1	3	2				1		
CO3		2	3			2	2	2				1		
CO4		1	1			3	3	2			1	2		
CO5						2	2	3				2		

UNIT – I

Introduction to Internet of Things: Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT - II

Machine-to-Machine Communications: Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

UNIT – III

Introduction to Python programming: Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.

UNIT - IV

Implementation of IoT with Raspberry Pi: Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics.

UNIT - V

Cloud Computing: Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT.

Case Study: Agriculture, Healthcare, Activity Monitoring

TEXT BOOKS:

1 The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2 “Make sensors”: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media, 2014.
3 "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti

REFERENCE BOOKS:

1 Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2 Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice".
3 Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- II Sem

L	T	P	C
3	0	0	3

22EC612OE: PRINCIPLES OF SIGNAL PROCESSING
Open Elective-I

Course Objectives: The course objectives are

1. To provide the fundamentals of Signals and Systems required for all Engineering related courses.
2. To furnish the basic characteristics of LTI systems
3. To hand over the knowledge on signal transmission requirements
4. To distribution of signal statistical properties and noise source concepts

Course outcomes: Up on completing this course ,the student will be able to

1 Apply the concept of Orthogonality on signals and systems
2 Design system using the concept of sampling theorem. And signal to noise ratios
3 Analyze system characteristics for given specifications.
4 Determine the Spectral and temporal characteristics of Signals.
5 Understand the concepts of signal to noiseratios.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3				3	2					1	3	2
CO2	3	2	2			1	3					3	2	2
CO3	3	3	3			3	2					2	3	3
CO4	3	3	2			1	3					3		3
CO5	3	2	3			1	2					2	3	2

UNIT I
Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

UNIT II
Signal Transmission through Linear Systems Linear System: Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

UNIT III
Sampling theorem: Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling — Aliasing, Introduction to Band Pass Sampling.

UNIT IV

Temporal characteristics of signals: Concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Time Averages and Ergodicity, Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Cross-Correlation Function and Its Properties, Power Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function.

UNIT V

Noise sources: Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties

TEXT BOOKS:

1 Signals, Systems & Communications
2 Probability, Random Variables & Random Signal Principles

REFERENCE BOOKS:

1 Signals and Systems - A.V. Oppenheim
2 Fundamentals of Signals and Systems - Michel J. Robert
3 Random Processes for Engineers-Bruce Hajck
4 Statistical Theory of Communication – S.P Eugene Xavier

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- II Sem

L	T	P	C
3	0	0	3

22EC613OE: DIGITAL ELECTRONICS FOR ENGINEERING
Open Elective-I

Course Objectives:

1 To provide basic understanding of properties and theorems of Boolean algebra.
2 To provide knowledge on logical gates.
3 To teach techniques to reduce the Boolean expressions using K map.
4 To understand the concepts of Combinational and Sequential circuits.
5 To give introduction to Logic families and integrated circuits.

Course Outcomes: Up on completion of this course, the students will be able to

1 Get basic knowledge on logic gates, Universal gates and their switching logics.
2 Realize Boolean expressions using NAND/NOR gates and reduce them using K map.
3 Design combinational and sequential circuits.
4 Acquire knowledge on realization of logic families using diodes and transistor.
5 Understand the internal operation of OP-AMP and its Specification.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1		3						1	2	
CO2	3	2	2	1		1						1	2	
CO3	2	3	3	2		2						2	2	
CO4	3	2	2	2		3						2	1	
CO5	2	2	2	1		2								

UNIT I

Number Systems: Number systems, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties. Boolean Algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT II

Minimization of Boolean functions: Karnaugh Map Method - Up to four Variables, Don't Care Map Entries, Tabular Method, **Combinational Logic Circuits**: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

UNIT III

Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Fundamentals of shift registers, ripple and decade counter.

UNIT IV

Realization of Logic Gates Using Diodes & Transistors: AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, CMOS transmission gate.

UNIT V

Integrated Circuits: Classification, chip size and circuit complexity, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC Characteristics, 741 opamp and its features, modes of operation-inverting, non-inverting, differential.

TEXT BOOKS:

1 Switching and Finite Automata Theory - ZviKohavi& Niraj K. Jha, 3rd Edition, Cambridge, 2010.
2 Modern Digital Electronics – R. P. Jain, 3rd Edition, 2007- Tata McGraw-Hill
3 Linear Integrated Circuits, D. Roy Chow dhury, New Age International(p) Ltd
4 Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI

REFERENCE BOOKS:

1 Digital Design- Morris Mano, PHI, 4th Edition,2006
2 Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI
3 Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, Denton J. Daibey, TMH.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

III Year B.Tech. ECE- II Sem

L	T	P	C
3	0	0	3

22EC614OE: OBJECT ORIENTED PROGRAMMING
Open Elective-I

Course Objectives:

1 To teach the student the concepts of object oriented and procedure programming
2 To differentiate between functions, classes and objects
3 To learnt overload functions and operators
4 To design applications using dynamic memory management techniques
5 To teach the student to implement generic programming and exception handling

Course Outcomes: Up on completing this course ,the student will be able to

1 To differentiate object oriented programming and procedural programming
2 To construct classes, functions and objects
3 To implement the constructors, destructors and inheritance
4 To develop programs using dynamic memory management techniques
5 To apply exception handling and generic programming.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1		1			2	3		2		
CO2	3	3	3	2		1			3	3	2	3		
CO3	3	3	3	2					3	3	2	3		
CO4	3	3	3	3	2	2	2	1	3	3	3	2		
CO5	3	3	3	3	3	2	2	1	3	3	3	2		

UNIT I

Introduction to Object Oriented Programming: Object oriented paradigm-Differences between Object Oriented Programming and Procedure oriented programming, Basic concepts of Object Oriented Programming, Encapsulation, Inheritance and Polymorphism, Benefits of OOP, Structure of a C++ program, namespace, Data types, C++ tokens, Identifiers, Variables, Constants, Operators, Control structures & Loops.

UNIT II

Functions, Classes and Objects:

Introduction of Classes, Class Definition, Defining a Members, Objects,Access Control, Class Scope, Scope Resolution Operator, Inline functions, Memory Allocation for Objects, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Friend Functions.

UNIT III

Constructors, Destructors, Inheritance:

Introduction to Constructors, Default Constructors, Parameterized Constructors, Copy Constructors, Multiple Constructors in a Class, Destructors.

Inheritance:

Introduction to inheritance, Defining Derived Classes, Single Inheritance, Multiple Inheritance, Multi level Inheritance, Hierarchical Inheritance, Hybrid Inheritance.

UNIT IV

Pointers, Virtual Functions and Polymorphism:

Introduction to Memory management, new operator and delete operator, Pointers to objects, Pointers to Derived Classes, Polymorphism, Compile time polymorphism, Run time polymorphism, Virtual Functions, Overloading- Function Overloading, Operator overloading.

UNIT V

Exception handling:

Basics of Exception Handling, Types of exceptions, Exception Handing Mechanism, Throwing and Catching Mechanism, Rethrowing an Exception, Specifying Exceptions.

Exception handling

Basics of Exception Handling,Typesofexceptions,ExceptionHandingMechanism,Throwingand Catching Mechanism, Rethrowing an Exception, Specifying Exceptions

TEXT BOOKS:

1 Object Oriented Programming withC++ by Balagurusamy

2 C++,the Complete Reference,4thEdition,HerbertSchildt,TMH

REFERENCE BOOKS:

1 C++Primer,3rdEdition,S.B.LippmanandJ.Lajoie,PearsonEducation

2 The C++ Programming Language,3rdEdition,B.Stroutstrup,PearsonEduc

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	1	0	4

22EC701PC: MICROWAVE ENGINEERING

Prerequisite: Antennas and Propagation

Course Objectives: This is a core course in Microwave Communications domain, and covers contents related to Microwave Theory and Techniques. The main objectives of the course are:

1 To get familiarized with microwave frequency bands, their applications and to Understand the characteristics of rectangular waveguides and micro strip lines.
2 To understand the limitations and losses of conventional tubes at microwave frequencies and analyze different types of microwave tubes, their structures , principles of microwave power generation, and to characterize their performance features and applications
3 To study different types of waveguide components and ferrite devices, to impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S-Matrix for various types of microwave junctions.
4 To study microwave solid state devices and to understand the concepts of microwave measurements, identify the equipment required and precautions to be taken, and get familiarized with the methods of measurement of microwave power and various other microwave parameters.

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

1 Apply the concepts of Maxwell's equations and derive performance characteristics of rectangular wave guides and cavity resonators.
2 Demonstrate types, structures and characteristics of microwave tubes.
3 Analyse structure and operational characteristics of Helix and M-type tubes
4 Select various waveguide components for different microwave applications and Evaluate t heir S- parameters.
5 Construct test bench using microwave tubes and solid state devices to measure various signal characteristics.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2		-	-	-	2	-		2	1
CO2	3	2	2	3	2		-	-	-		-		2	1
CO3	3	3	2	2	2		-	-	-	3	-		2	1
CO4	3	3	2	3	1	-	-	-	-	2	-	-	2	1
CO5	3	2	2	2									2	1

UNIT-I

Microwave Transmission Lines - I: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross- section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations, Power Transmission, Impossibility of TEM Mode. Illustrative Problems, Micro strip Lines– Introduction, Zo Relations, and Effective Dielectric Constant.

Cavity Resonators– Introduction, Rectangular Cavities, Dominant Modes and Resonant Frequencies, Q Factor and Coupling Coefficients, Illustrative Problems

UNIT-II

Microwave Tubes: Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications, O-type Tubes : 2 Cavity Klystrons – Structure, Re-entrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for O/P

Power and Efficiency. Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and O/P Characteristics, Illustrative Problems

UNIT-III

Helix TWTs: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

M-Type Tubes: Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics, Illustrative Problems

UNIT- IV

Waveguide Components and Applications: Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads.

Waveguide Attenuators – Different Types, Resistive Card and Rotary Vane Attenuators; Waveguide Phase Shifters – Types, Dielectric and Rotary Vane Phase Shifters ,Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator Circulator.

Scattering Matrix– Significance, Formulation and Properties, S Matrix Calculations for – Waveguide Multiport Junctions E plane and H plane Tees, Magic Tee, Directional Couplers – 2 Hole, Bethe Hole types, Circulator Illustrative Problems

UNIT- V

Microwave Solid State Devices: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Introduction to Avalanche Transit Time Devices.

Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions, Microwave Power Measurement, Bolometer. Measurement of Attenuation, Frequency. Standing Wave Measurements – Measurement of Low and High VSWR, Cavity Q, Impedance Measurements.

TEXT BOOKS:

1 Microwave Devices and Circuits Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2 Electronic Communications Systems- Wayne Tomasi, Pearson, 5th Edition

REFERENCE BOOKS:

1 Optical Fiber Communication Gerd Keiser, TMH, 4th Ed., 2008.
2 Microwave Engineering - David M. Pozar, John Wiley & Sons (Asia) Pvt Ltd., 1989, 3r ed., 2011
3 Microwave Engineering - G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012
4 Electronic Communication System George Kennedy, 6th Ed., McGrawHill

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC731PE : DIGITAL IMAGE PROCESSING
Professional Elective – III

Course Objectives: Up on completing this course ,the student will be able to

1 To study the image fundamentals and mathematical transforms necessary for image processing.
2 To study the image enhancement techniques in time and frequency domain
3 To study image restoration procedures.
4 To expertise the image segmentation and compression techniques
5 To understand the Morphological operations on an image

Course Outcomes: Up on completing this course ,the student will be able to

1 Review the fundamental concepts of a digital image processing system
2 Analyze images in the frequency domain using various transforms.
3 Evaluate the techniques for image enhancement and image restoration
4 Categorize various compression techniques
5 Interpret image segmentation and Image compression standards.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	1	1	-	-	-	-	1	3	1
CO2	3	3	2	2	3	1	1	-	-	-	-	1	3	3
CO3	3	3	2	2	3	1	1	-	-	-	-	1	3	3
CO4	3	3	2	2	3	1	1	-	-	-	-	1	3	3
CO5		2		2	2			-	-	1	-	1		2

UNIT-I

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT-II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT-III

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT- IV

Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection, thresholding, Region Oriented Segmentation.

Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation

UNIT- V

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards**.**

TEXT BOOKS:

1 RafaelC.Gonzalez,RichardE.Woods-DigitalImageProcessing,3rdEdition,Pearson,2008
2 SJayaraman, SEsakkirajan, TV eera kumar- Digital Image Processing--TMH,2010.

REFERENCE BOOKS:

1 Scotte Umbaugh- Digital Image Processing and Analysis-Humanand Computer Vision Application with using CVIP Tools, 2ndEd, CRC Press, 2011
2 Rafael C.Gonzalez, Richard EWoods and StevenL. Eddings-Digital Image Processingusing MATLAB, 2ndEdition, TMH, 2010.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC732PE : CMOS ANALOG IC DESIGN
Professional Elective – III

Pre-Requisite: Analog Electronics

Course Objectives: Analog circuits play a very crucial role in all electronic systems and due to continued miniaturization; many of the analog blocks are not getting realized in CMOS technology.

1 To understand most important building blocks of all CMOS Analog ICs.
2 To study the basic principle of operation, the circuit choices and the trade-offs involved in the MOS transistor level design common to all Analog CMOS ICs.
3 To understand specific design issues related to single and multistage voltage, current and differential amplifiers, their output and impedance issues, bandwidth, feedback and stability.
4 To understand the design of differential amplifiers, current amplifiers and OPAMPs.

Course Outcomes (COs): Up on completing this course ,the student will be able to

1 To understand most important building blocks of all CMOS Analog ICs.
2 To study the basic principle of operation, the circuit choices and the trade-offs involved in the MOS transistor level design common to all Analog CMOS ICs.
3 To understand specific design issues related to single and multistage voltage, current and differential amplifiers, their output and impedance issues, bandwidth, feedback and stability.
4 To understand the design of differential amplifiers, current amplifiers and OPAMPs.
5 To understand the characterization of comparators and the operation of two-stage and pen-loop comparators

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				2					2		2	3	
CO2	2	2	3	2	2			2		2	2	2	3	
CO3	2	2	3	2	3		2			2	2	2	3	3
CO4	2	3	2	3	2		2	3	2	2	2	2	3	3
CO5	2	2	2	3	2		2	2	2	2	2	2	3	3

UNIT-I

MOS Devices and Modeling

The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT-II

Analog CMOS Sub-Circuits

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors- Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Bandgap Reference

UNIT-III

CMOS Amplifiers

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures

UNIT- IV

CMOS Operational Amplifiers

Design of CMOS Op-Amps, Compensation of Op-Amps, Design of Two-Stage Op-Amps, Power- Supply, Rejection Ratio of Two-Stage Op-Amps, Cascode Op-Amps, Measurement Techniques of OP- Amp.

UNIT- V

Comparators

Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

TEXT BOOKS:

1 Philip E. Allenand Douglas, R. Holberg – CMOS Analog Circuit Design, Oxford University Press, International Second Edition/Indian Edition, 2010.
2 Paul R. Gray, Paul J. Hurst, S. Lewis and R.G. Meyer -Analysis and Design of Analog Integrated Circuits, 5^{th} edition, Wiley India, 2010.

REFERENCE BOOKS:

1 David A. Johns, Ken Martin- Analog Integrated Circuit Design, Wiley Student Edn,2013
2 Behzad Razavi – Design of Analog CMOS Integrated Circuits, TMH
3 Baker, Liand Boyce - CMOS: Circuit Design, Layout and Simulation, PHI.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC733PE: CODING TECHNIQUES
Professional Elective – III

Prerequisite: Analog and Digital Communications

Course Objectives:

1 To introduce the concept of information in Communication theory
2 To give an idea on different coding techniques for reliable data transmission.
3 To study about different error detecting and error correcting codes like block codes, cyclic codes and convolution codes
4 To study the applications of different coding schemes
5 To gain knowledge on how coding schemes impacts the design of an optimum communication receiver.

Course Outcomes: Up on completing this course ,the student will be able to

1 Learn measurement of information and errors
2 Obtain knowledge in designing various source codes and channel codes
3 Design encoders and decoders for block and cyclic codes
4 Understand the significance of codes in various applications
5 To design an optimum decoder for various coding schemes.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	1	2	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	2	1	-	-	-	-	-	-	1	3	3
CO4	1	1	1	1	-	-	-	-	-	-	-	1	2	2
CO5	2	2	2	2	1	-	-	-	-	-	-	1	3	3

UNIT – I:
Coding for Reliable Digital Transmission and storage
Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.

UNIT – II: Linear Block Codes:
Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT – III: Cyclic Codes:
Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes**.**

UNIT – IV: Convolution Codes
Encoding of Convolution Codes- Structural and Distance Properties, state, tree, trellis diagrams,

maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolution codes in ARQ system.

UNIT – V: BCH Codes:
Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

TEXT BOOKS:

1 Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.
2 Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989

REFERENCE BOOKS:

1 Digital Communications- John G. Proakis, 5th ed., , TMH 2008.
2 Introduction to Error Control Codes-Salvatore Gravano-oxford
3 Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC741PE : RADAR SYSTEMS
Professional Elective – IV

Prerequisite: Analog and Digital Communications

Course Objectives:
1 To explore the concepts of radar and its frequency bands
2 To understand Doppler Effect and get acquainted with the working principles of CW radar, FM- CW radar.
3 To impart the knowledge of functioning of MTI and Tracking Radars.
4 To impart the knowledge of functioning of MTI and Tracking Radars.
5 To study the functions of various blocks of Radar receivers and detection of Radar signals in noise in detail

Course Outcomes: Up on completing this course ,the student will be able to
1 Understand the complete radar range equation
2 Familiarize the functioning of CW, FM-CW and MTI radars
3 Analyze various Tracking methods
4 Derive the matched filter response characteristics for radar receivers.
5 Distinguish the types of display devices & duplexers

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	1	1	-	-	-	-	1	2	1
CO2	2	1	2	2	-	-	-	-	-	-	-	1	2	1
CO3	3	2	2	2	-	1	1	-	-	-	-	1	1	1
CO4	3	2	2	2	-	1	1	-	-	-	-	1	2	2
CO5	2	1	1	1	1	1	1					1	1	1

UNIT – I
Basics of Radar: Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation.
Radar Equation: SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment).

UNIT – II
CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar.
FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter

UNIT – III
MTI and Pulse Doppler Radar: Principle, MTI Radar - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers — Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

UNIT – IV

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar — Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers

UNIT – V

Detection of Radar Signals in Noise Matched Filter Receiver — Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

Radar Receivers – Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

TEXT BOOKS:

1 Merrill I. Skolnik- Introduction to Radar Systems, 2nd Edition, TMH Special Indian Edition, 2007

REFERENCE BOOKS:

1 Byron Edde - Radar: Principles, Technology, Applications, Pearson Education, 2004
2 Peebles, Jr., P.Z., Wiley - Radar Principles, New York, 1998.
3 Mark A. Richards, James A. Scheer, William A. Holm, Yesdee - Principles of Modern Radar: Basic Principles, 2013
4 Merrill I. Skolnik -Radar Handbook, 3rd Edition., McGraw-Hill Education, 2008

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC742PE : SATELLITE COMMUNICATIONS
Professional Elective – IV

Prerequisite: Analog and Digital Communications

Course Objectives: The course objectives are
1 To acquired foundation in orbital mechanics and launch vehicles for the satellites.
2 To provide students with solid foundation in orbital mechanics and launches for the satellite communication.
3 To provide basic knowledge of link design of satellite.
4 To understand multiple access systems and earth station technology
5 To understand the concepts of satellite navigation and GPS.

Course outcomes: Up on completing this course ,the student will be able to
1 Apply the basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles
2 Analyze the satellite sub systems and design satellite links for specified C/N.
3 Distinguish the various multiple access techniques for satellite communication systems and earth station technologies.
4 Analyze the concept of satellites sub systems like telemetry, tracking, command and monitoring power systems
5 Evaluate the concepts of LEO, GEO Stationary Satellite Systems and satellite navigation

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1					1	2	1
CO2	3	2	2	2		1	1					1	2	
CO3	3	2	2	1		1	1					1	1	
CO4	3	2	2	2		1	1					1	2	
CO5	3	2	2	1		1	1					1	2	

UNIT – I

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle determination, Orbital Perturbations, Orbit determination, Launches and Launch vehicles, Orbital Effects in Communication Systems Performance

UNIT – II

Satellite Subsystems: Attitude and Orbit Control System, Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification

UNIT – III

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples.

Multiple Access: Frequency Division Multiple Access (FDMA), Inter modulation, Calculation of C/N, Time Division Multiple Access (TDMA), Frame Structure, Examples, Satellite Switched TDMA Onboard Processing, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception.

UNIT – IV

Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods.

UNIT – V

Low Earth Orbit and Geo-Stationary Satellite Systems: Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational NGSO Constellation Designs.

Satellite Navigation & Global Positioning System: Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, GPS Receiver Operation, GPS C/A Code Accuracy, Differential GPS

TEXT BOOKS:

1 Timothy Pratt, Charles Bostian and Jeremy Allnutt – Satellite Communications, WSE, Wiley Publications, 2nd Edition, 2003.
2 Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud - Satellite Communications Engineering, 2nd Edition, Pearson Publications, 2003.

REFERENCE BOOKS:

1 M. Richharia - Satellite Communications : Design Principles, 2nd Edition, BS Publications, 2003
2 D.C Agarwal - Satellite Communication, 5th Edition, Khanna Publications,
3 K.N. Raja Rao - Fundamentals of Satellite Communications, PHI, 2004
4 Dennis Roddy - Satellite Communications, 4th Edition, McGraw Hill, 2009.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC743PE :BIOMEDICAL INSTRUMENTATION
Professional Elective – IV

Course Objectives: The course objectives are
1 Identify significant biological variables at cellular level and ways to acquire different bio-signals.
2 To explore the human body parameter measurements setups
3 Elucidate the methods to monitor the activity of the heart, brain, eyes and muscles.
4 Introduce therapeutic equipment for intensive and critical care.
5 Outline medical imaging techniques and equipment for certain diagnosis and therapies.

Course Outcomes: Up on completing this course ,the student will be able to
1 Apply the basic medical instrumentation system and bioelectric potentials
2 Distinguish Various ECG measurements like medical recorders for doctors to identify heart related diseases
3 Analyze the concepts in neuro muscular instrumentations
4 Evaluate various blood element measurements and functioning of pacemakers and defibrillator
5 Illustrate the various Intensive Care Equipment

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3			3	2					3	
CO2	3	3	3	3		2	3	3					2	
CO3	3	3	2	2		3	3	3					3	3
CO4	3	3	3	2	3	3	2	3				3	3	2
CO5	3	3	3	2	2	2	2	2				2	3	3

UNIT – I

Bio-Potential Signals and Electrodes: Bio-signals and their characteristics, Organization of cell, Nernst equation of membrane, Resting and Action potentials. Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems. Bio-potential electrodes – Body surface recording electrodes, Internal electrodes, micro electrodes. Bio-chemical transducers – reference electrode, the pH electrodes, Blood gas electrodes.

UNIT – II

Cardiovascular Instrumentation: Heart and cardiovascular system Heart electrical activity, blood pressure and heart sounds. Cardiovascular measurements electro cardiography — electrocardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

UNIT – III

Neurological Instrumentation: Neuronal communication, electro encephalogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, preamplifiers and amplifiers. EMG block diagram and Stimulators

UNIT – IV

Equipment for Critical Care: Therapeutic equipment - Pacemaker, Defibrillator, Shortwave diathermy, Hem dialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators.

UNIT – V

Principles of Medical Imaging: Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography, Introduction to Telemedicine.

TEXT BOOKS:

1 R.S. Khandpur - Hand-book of Biomedical Instrumentation, McGraw-Hill, 2003.
2 John G. Webster = Medical Instrumentation, Application and Design, John Wiley.

REFERENCE BOOKS:

1 Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer - Biomedical Instrumentation and Measurements, PHI.
2 L.A. Geoddes and L.E. Baker - Principles of Applied Biomedical Instrumentation, John Wiley and Sons.
3 Joseph Carr and Brown - Introduction to Biomedical equipment technology

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem	**L**	**T**	**P**	**C**
	2	**0**	**0**	**2**

22HS701MS: PROFESSIONAL PRACTICE, LAW AND ETHICS

Course Objectives:

1 Understanding Professional Ethics: To comprehend the fundamental principles of professional ethics, particularly in engineering, and differentiate them from personal ethics.
2 Comprehending Contract Law: To understand the essential elements, types, and enforceability of contracts, including the remedies for breach and specific contracts like indemnity and agency.
3 Alternative Dispute Resolution: To gain knowledge of arbitration, conciliation, and other ADR mechanisms, including their legal frameworks, processes, and roles in resolving disputes
4 Labor Laws and Engagement: To learn about the various laws and regulations related to labor in the construction industry, including methods of engagement and key legislative acts.
5 Intellectual Property Law: To acquire a foundational understanding of intellectual property laws, including copyrights, trademarks, patents, and their relevance to engineering and technology.

Course Outcome: Up on completing this course ,the student will be able to

1 Explain the concept of professional ethics and identify ethical issues in engineering practice.
2 Demonstrate a clear understanding of contract law, including the ability to draft and analyze contracts relevant to engineering and construction
3 Compare and contrast various alternative dispute resolution methods and apply them appropriately to resolve engineering disputes
4 Analyze labor laws and regulations to ensure compliance in construction projects and address labor-related issues effectively.
5 Explain the principles of intellectual property law and apply them to protect innovations and manage intellectual property in engineering contexts.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1							2						
CO2		1						2						
CO3	1		1			1		2						
CO4	2	1				1		2						
CO5	1				1			3				2		

UNIT- I

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

UNIT- II

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

UNIT- III

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats

UNIT- IV

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

UNIT- V

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970.

TEXT BOOKS:

1 R. Subramanian - Professional Ethics, Oxford University Press, 2015.
2 Ravinder Kaur - Legal Aspects of Business, 4th edition, Cengage Learning, 2016.

REFERENCE BOOKS:

1 RERA Act, 2017.
2 Wadhera - Intellectual Property Rights, Universal Law Publishing Co., 2004.
3 T. Ramappa - Intellectual Property Rights Law in India, Asia Law House, 2010.
4 O.P. Malhotra - Law of Industrial Disputes, N.M. Tripathi Publishers.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
0	0	2	1

22EC702PC: MICROWAVE ENGINEERING LAB

Course Objectives: The students will

1 The goal of this course is to introduce students to the concepts and principles of the advanced Microwave engineering.

2 To understand the operation of different types of Microwave sources.

Course Outcome: Up on completing this course ,the student will be able to

1 Calculate the performance characteristics of microwave tube
2 Sketch square wave modulation by applying Gunn diode characteristics.
3 Analyse the scattering parameter for various microwave junction.
4 Evaluate different parameter of a waveguide.
5 Investigate radiation pattern of Horn antenna.

Cos	PROGRAMME OUTCOMES													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1									2	1
CO2	3	1	2	1									2	1
CO3	3	1	2	1									2	1
CO4	3	1	2	1						2			2	1
CO5	3	1	2	1						2			2	1

Note: Any **twelve** of the following experiments

List of Experiments:

1 Reflex Klystron Characteristics
2 Gunn Diode Characteristics
3 Directional Coupler Characteristics
4 VSWR Measurement
5 Square wave modulation using Gunn diode
6 Measurement of Waveguide Parameters.
7 Impedance Measurement.
8 Measurement of Scattering Parameters of a E plane Tee
9 Measurement of Scattering Parameters of a H plane Tee
10 Measurement of Scattering Parameters of a Magic Tee
11 Measurement of Scattering Parameters of a Circulator
12 Attenuation Measurement
13 Frequency Measurement.
14 Antenna Pattern Measurements.

Equipment & Components Required:

1 Gunn diode
2 Klystron power supply
3 Klystron mount
4 Isolator
5 Frequency meter
6 Variable attenuator
7 Slotted section
8 . Tunable Probe
9 Detector moun

10	Matched termination
11	VSWR meter
12	waveguide stands
14	Directional coupler
15	Circulator
16	E-plane tee
17	H-plane tee
18	Horn Antenna
19	Parabolic Reflector
20	Gunn power supply
21	Pin modulator

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
0	0	2	1

22EC703PC: SCRIPTING LANGUAGES LAB

Prerequisites: Any High-level programming language (C, C++)

Course Objectives:

- To Understand the concepts of scripting languages for developing web-based projects
- To understand the applications the of Ruby, TCL, Perl scripting languages

Course Outcomes: Up on completing this course ,the student will be able to

1 Acquire the skills for expressing syntax and semantics informal notation
2 Identify and apply a suitable programming paradigm for a given computing application
3 Gain knowledge of and able to compare the features of various programming languages
4 Demonstrate the use of scripting languages
5 Demonstrate various data types of different programming languages.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3				2	1		2		
CO2	2	2	2	2	2				2	1		3		
CO3	2	2	2	2	2				2	1		2		
CO4	3	2	2	2	2				2	1		3		
CO5	3	2	2	2	2				2	1		2		

List of Experiments:

1 Write a Ruby script to create a new string which is n copies of a given string where n is a non- negative integer
2 Write a Ruby script which accept the radius of a circle from the user and compute the parameter and area
3 Write a Ruby script which accept the user's first and last name and print them in reverse order with a space between them
4 Write a Ruby script to accept a filename from the user print the extension of that
5 Write a Ruby script to find the greatest of three numbers
6 Write a Ruby script to print odd numbers from 10 to 1
7 Write a Ruby scirpt to check two integers and return true if one of them is 20 otherwise return their sum
8 Write a Ruby script to check two temperatures and return true if one is less than 0 and the other is greater than 100
9 Write a Ruby script to print the elements of a given array
10 Write a Ruby program to retrieve the total marks where subject name and marks of a student stored in a hash
11 Write a TCL script to find the factorial of a number
12 Write a TCL script that multiplies the numbers from 1 to 10
13 Write a TCL script for Sorting a list using a comparison function
14 Write a TCL script to (i)create a list (ii)append elements to the list (iii)Traverse the list (iv)Concatenate the list
15 Write a TCL script to comparing the file modified times
16 Write a TCL script to Copy a file and translate to native format.
17 a) Write a Perl script to find the largest number among three numbers.

b) Write a Perl script to print the multiplication tables from 1-10 using subroutines.

18 Write a Perl program to implement the following list of manipulating functions
a) Shift b)Un shift c)Push

19 a) Write a Perl script to substitute a word, with another word in a string.
b) Write a Perl script to validate IP address and email address.

20 Write a Perl script to print the file in reverse order using command line arguments

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC721OE : ELECTRONIC SENSORS
Open Elective-II

Course Objectives: The course objectives are
1 Learn the characterization of sensors
2 Known the working of Electromechanical, Thermal, Magnetic and radiation sensors
3 Understand the concepts of Electro analytic and smart sensors
4 Undertake complex and unstructured problem-solving real time challenges using Sensors
5 Able to use sensors in different applications

Course Outcomes: Up on completing this course ,the student will be able to
1 Learn about sensor Principle, Classification and Characterization.
2 Explore the working of Electromechanical, Thermal, Magnetic, radiation and Electro analytic sensors
3 Understand the basic concepts of Smart Sensors
4 Interpret the given case study situation related to applications of sensors.
5 Design a system with sensors

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3			3	2					3	
CO2	3	3	3	3		2	3	3					3	
CO3	3	3	2	2		3	2	3					2	3
CO4	3	3	3	2	3	3	3	3				3	3	2
CO5	3	3	3	2	2	2	2	2				2	3	3

UNIT – I

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors

UNIT – II

Thermal Sensors: Introduction ,Gas thermometric Sensors ,Thermal Expansion Type Thermometric Sensors ,Acoustic Temperature Sensor ,Dielectric Constant and Refractive Index thermo sensors ,Helium Low Temperature Thermometer ,Nuclear Thermometer ,Magnetic Thermometer ,Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors

UNIT – III

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

UNIT – IV

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media

UNIT - V

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing — Sensors for environmental Monitoring

TEXT BOOKS:

1 "Sensors and Transducers - D. Patranabis" –PHI Learning Private Limited., 2003.
2 Introduction to sensors- John veteline, aravindraghu, CRC press, 2011

REFERENCE BOOKS:

1 Sensors and Actuators, D. Patranabis, 2nd Ed., PHI, 2013.
2 Make sensors: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media, 2014.
3 Sensors handbook- Sabriesoloman, 2nd Ed. TMH, 2009

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC722OE :ELECTRONICS FOR HEALTH CARE
Open Elective-II

Course Objective:
1 To provide knowledge on Healthcare data
2 To demonstrate need of Electronics in HealthCare.
3 To give basic knowledge on electronic equipments used in medical field.
4 To learn the concepts of Telemedicine used inside the human body
5 To familiarize the concept of therapeutic devices used inside the human body.

Course Outcomes: Up on completion of this course the students will be able to
1 Apply the concept of health care data conversion to information and knowledge
2 Analize the Electronic Health Records (EHR) and their Implementation.
3 Distinguish various electronic devices used for the patient monitoring.
4 Analize the concepts of Telemedicine used inside the human body
5 Evaluate the concept of therapeutic devices used inside the human body

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	1	1	1	-	-	1	-	-	1	2	1
CO2	2	2	-	1	1	1	-	-	1	-	-	1	1	1
CO3	2	2	-	1	1	1	-	-	1	-	-	1	2	2
CO4	2	2	-	1	1	1	-	-	1	-	-	1	2	
CO5	2	2		1	1	1			1			1	2	2

UNIT – I
Health care data, Information and Knowledge: Definitions and Concepts, Converting Data to Information to Knowledge, Clinical Data Warehouses, What makes Health Informatics Difficult, Why Health IT fails Sometimes, Terminology of Analytics, Challenges to Data Analytics, Research and application of analytics, Role of Informatics in analytics.

UNIT – II
Electronic Health Records: Introduction, Need for Electronic Health Records, Institute of Medicine's Vision for EHRs, Electronic Health Record Key Component, Electronic Prescribing, Electronic Health Record Adoption, Electronic Health Record Adoption and Meaningful use Challenges, Electronic Health Record Examples, Logical Steps to Selecting and Implementing an HER

UNIT – III
Patient Monitoring Systems: System Concepts, Cardiac Monitor, Bedside Patient Monitoring Systems, Central Monitors, Measurement of Heart Rate, Measurement of Pulse Rate, Blood Pressure Measurement, Measurement of Temperature, Measurement of Respiration Rate, Catheterization Laboratory Instrumentation.

UNIT – IV
Biomedical Telemetry and Telemedicine: Wireless Telemetry, Single Channel Telemetry Systems, Multi-channel Wireless Telemetry Systems, Multi-patient Telemetry, Implantable Telemetry Systems, Transmission of Analog Physiological Signals, Over Telephone, Telemedicine

UNIT – V

Therapeutic devices: Need for Cardiac Pacemaker, Implantable Pacemakers, DC Defibrillator, Electronics in the Anaesthetic Machine

TEXT BOOKS:

1 Robret E. Hoyt MD FACP "Health Informatics" sixth edition 2007
2 R. S. Kandpur "Biomedical Instrumentation Technology and Applications" second edition Tata McGraw-Hill

REFERENCE BOOKS:

1 Edward H. Shortlliffe, James J.Cimino "Biomedical Informatics, Computer applications in Health care and Biomedicine**"** third edition Springer.
2 G.V.R.K. Acharyulu, Bhimaraya Metri, L. Kalyan Viswanath REDDY "Health care and Hospital Management Contemporary Issues and Strategies".

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- I Sem

L	T	P	C
3	0	0	3

22EC723OE : TELECOMMUNICATIONS FOR SOCIETY
Open Elective-II

Course Objectives: The aim of this course is

1 To introduce Telecommunications and its vast development
2 To give knowledge on voice, Data and image transmission.
3 To treat with different types of noise/distortions that occurs during transmissions
4 To make topics like TV transmission by satellite and broadcasting understandable.
5 To provide information on Evolution, Digital Transmission, Frequency Plan, and other General Information of CATV

Course Outcomes: Up on completion of this course, the students will be able to

1 Understand the differences between simplex, half duplex, and full duplex modes in one-way and two-way communication circuits.
2 Gain understanding of subscriber loop design and voice frequency (VF) repeaters used in voice telephony.
3 Obtain a brief overview of video transmission and broadcasting standards in television
4 Understand the various modes of television transmission
5 Examine the evolution, digital transmission methods and Frequency Plan etc., of community antenna Television

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	1	-	-	-	-	1	-	-	1	2	1
CO2	1	1	-	1	-	-	-	-	1	-	-	1	1	1
CO3	1	1	-	1	-	-	-	-	1	-	-	1	2	1
CO4	1	1	-	1	-	-	-	-	1	-	-	1	1	1
CO5	1	1	1	1									1	1

UNIT - I

Introductory Topics in Telecommunications: End-Users, Nodes, and Connectivity's, Telephone Numbering and Routing, Use Of Tandem Switches in aLocal Area Connectivity, Introduction to the Busy Hour and Grade Of Service, Simplex, Half-Duplex, and Full Duplex, One-Way and Two-Way Circuits, Network Topologies, Variations in Traffic Flow, Quality Of Service, Standardization in Telecommunications, The Organization of the PSTN in the United States, Points Of Presence.

UNIT – II

Quality of Service and Telecommunication Impairments: Objective, Quality of Service: Voice, Data, and Image, Signal-to-Noise Ratio, Voice Transmission, Data Circuits, Video (Television), The Three Basic Impairments and How They Affect the End-User, Amplitude Distortion, Phase Distortion, Noise Level, Typical Levels, Echo and Singing.

UNIT – III

Transmission Aspects of Voice Telephony: Definition of the Voice Channel, Operation of the Telephone Subset, Subscriber Loop Design, Design of Local Area Wire-Pair Trunks (Junctions), VF Repeaters (Amplifiers).

UNIT – IV

Television Transmission: Background and Objectives, An Appreciation of Video Transmission,

Critical Video Parameters, Video Transmission Standards (Criteria for Broadcasters), Methods of Program Channel Transmission, The Transmission of Video Over LOS Microwave, TV Transmission by Satellite Relay, Digital Television, Conference Television, Brief Overview of Frame Transport for Video Conferencing

UNIT – V

Community Antenna Television (Cable Television): Objective and Scope, The Evolution of CATV, System Impairments and Performance Measures, Hybrid Fiber-Coax (HFC) Systems, Digital Transmission of CATV Signals, Two-Way CATV Systems, Two-Way Voice and Data over CATV Systems Based on the DOCSIS 2.0 Specification, Subsplit/Extended Subsplit Frequency Plan, Other General Information.

TEXT BOOKS:

1 Roger L. Freeman "Fundamentals of Telecommunications" 2nd Edition, John Wiley & Sons Publications 2005.
2 Annabel Z. Dodd "The Essential Guide to Telecommunications" 5thEdition , Prentice Hall 2012.

REFERENCE BOOKS:

1 JYRKI T. J. PENTTINEN "THE TELECOMMUNICATIONS HANDBOOK" John Wiley & Sons Publications 2015.
2 Prof. Dr. Muhammad EL-SABA "Telecommunications systems and data networks" 3rd Edition 2015.

TEEGALA KRISHNA REDDY ENGINEERING COLLEGE

IV Year B.Tech. ECE- II Sem

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22EC851PE : 5G AND BEYOND COMMUNICATIONS
Professional Elective – V

Course Objectives: The aim of this course is

1 Understand and describe modern mobile communication systems, including their architecture, functions, and technological advancements.
2 Solve complex problems in multi-user communication by using strategic approaches and effective solutions.
3 Evaluate technical solutions based on 5G/LTE concepts to meet specific performance requirements.
4 Independently work on advanced projects creatively and communicate findings effectively through oral presentations and written reports
5 Explore and analyze major challenges in mobile communication, focusing on developments beyond 2020 and emerging technologies

Course Outcomes: Up on completion of this course, the students will be able to

1 Examining and explaining contemporary mobile communication systems comprehensively
2 Creating and managing difficult problems in multi-user communication involves solving problems strategically and using effective strategies.
3 Evaluating technical solutions based on 5G/LTE concepts that meet specific performance needs.
4 Being capable of autonomously working creatively on advanced projects, and effectively communicating findings both verbally and in writing to justify and discuss conclusions reached.
5 Explore and analyze the major challenges, focusing on developments beyond 2020.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	1	-	-	-	-	1	2	1
CO2	3	3	2	2	1	1	1	-	-	-	-	1	2	1
CO3	3	3	2	2	3	1	1	-	-	-	-	1	2	1
CO4	3	3	2	2	3	1	1	-	-	-	-	1	2	1
CO5	3	3	2	2									2	1

UNIT – I Multiple Input Multiple Output (MIMO) Communications:
Spatial Multiplexing, Spatial Diversity, Beam forming in MIMO systems, Hybrid Precoding, 5G Communication Landscape, Related work on 5G.

UNIT – II Introduction to Mobile Wireless Technology Generations:
5G, WISDOM, GIMVC, Requirements of 5G, standardization of WISDOM, Vision of 5G, WISDOM Concept and Challenges, Cellular D2D Communication, D2D Using Physical Layer Network Coding, Using FFR and Using Cognitive Radio.
SMNAT: Introduction, Network Architecture and the Process, Implementation of SMNAT for In-Band- D2D and Interoperability with WISDOM, Description of Network elements of SMNAT and Call Flow for Session Establishment

UNIT - III: Radio Wave Propagation for Mm Wave:

Introduction, Large-scale Propagation Channel Effects, Small-Scale Channel Effects, Spatial Characterization of Multipath and Beam Combing, Outdoor Channel Models, Indoor Channel Models.

UNIT - IV: Higher layer Design Considerations for Mm Wave:

Challenges when Networking Mm Wave Devices, Beam Adaptation Protocols, Relaying for Coverage Extension, Support for Multimedia Transmission, Multiband considerations, Performance of Cellular networks, Mm Wave Standardization: ECMA-387, IEEE 802.11ad.

UNIT - V: BEYOND 2020

Major Challenges Surrounding Future Cyber Security, Users Awareness, Spectrum Related Security Issues in CRNs. Challenges for 2020 and beyond, Future Mobile Technologies, High Altitude Stratospheric Platform Station Systems, Human Bond Communications, CONASENSE.

TEXT BOOKS:

1 Ramjee Prasad, 5G: 2020 and Beyond, River Publisher
2 T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock, Millimetre Wave Wireless Communication, Pearson Education, 2015.

REFERENCE BOOKS:

1 M. Manish, G. Devendra, P. Pattanayak, and N. Ha, 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology
2 M. Vaezi, Z. Ding, and H. V. Poor, Multiple Access techniques for 5G Wireless Networks and Beyond, Springer Nature, Switzerland, 2019

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IV Year B.Tech. ECE- II Sem

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22EC852PE :ARTIFICIAL INTELLIGENCE
Professional Elective – V

Course Objectives: The objectives of the course are to:
1 To impart knowledge about Artificial Intelligence.
2 To give understanding of the main abstractions and reasoning for intelligent systems.
3 To enable the students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes: Up on completing this course, the students will be able to
1 Understand the basics of the theory and about intelligent agents
2 Capable of using heuristic searches, aware of knowledge based systems and expert systems.
3 Apply AI techniques to real-world problems to develop intelligent systems.
4 Select appropriately from a range of techniques when implementing intelligent systems.
5 Ability to design Expert system

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3		3		2			3	3		3		
CO2	2			2		2						2		
CO3		2	2						2			2		
CO4	3	3		3		2			3					
CO5	2	2	2			2				2		2		

UNIT- I: Introduction
Introduction–Definition – foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation

UNIT- II: Problem Solving Methods
Problem solving Methods – Search Strategies- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT- III: Knowledge Representation
First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information

UNIT- IV: Knowledge Acquisition
Introduction to Learning, Rule Induction, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning. Learning Using neural Networks, Probabilistic Learning Natural Language Processing

UNIT- V: Expert systems
Introduction, basic concepts, structure of expert systems, the human element in expert systems

how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty.

TEXT BOOKS:

1 S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education
2 David Poole, Alan Mackworth, Randy Goebel," Computational Intelligence: a logical approach", Oxford University Press

REFERENCE BOOKS:

1 G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education
2 J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

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IV Year B.Tech. ECE- II Sem

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22EC853PE : OPTICAL COMMUNICATIONS
Professional Elective – V

Course Objectives: The objectives of the course are to:
1 To realize the significance of optical fibre communications.
2 To understand the construction and characteristics of optical fibre cable.
3 Develop the knowledge of optical signal sources and power launching.
4 To identify and understand the operation of various optical detectors.
5 To understand the design of optical systems and WDM.

Course Outcomes: Up on completing this course ,the student will be able to:
1 Illustrate the features of optical fibers ,interpret the parameters and types of single mode fibers
2 Demonstrate signal distortions in optical fibers
3 Explain fiber splicing, optical sources and source to fiber power launching
4 Evaluate various stages of optical detectors
5 Construct an optical communication system for given design parameters.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	1	-	-	-	-	1	1	1
CO2	3	3	2	2	1	1	1	-	-	-	-	1	1	1
CO3	3	3	2	2	3	1	1	-	-	-	-	1	1	1
CO4	3	3	2	2	3	1	1	-	-	-	-	1	1	1
CO5	3	3	2	2									2	1

UNIT - I

Overview of Optical Fiber Communication: Historical development, The general system, Advantages of Optical Fiber Communications, Optical Fiber Wave Guides- Introduction, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays,Cylindrical Fibers- Modes,V number, Mode Coupling, Step Index Fibers, Graded Index Fibers. Single Mode Fibers- Cut Off Wavelength, Mode Field Diameter, Effective Refractive Index,Fiber Materials Glass, Halide, Active Glass, Chalgenide Glass, Plastic Optical Fibers.

UNIT - II

Signal Distortion in Optical Fibers: Attenuation, Absorption, Scattering and Bending Losses, Core and Cladding Losses, Information Capacity Determination, Group Delay, Types of Dispersion - Material Dispersion, Wave-Guide Dispersion, Polarization Mode Dispersion, Intermodal Dispersion, Pulse Broadening, Optical Fiber Connectors- Connector Types, Single Mode Fiber Connectors, Connector Return Loss.

UNIT - III

Fiber Splicing: Splicing Techniques, Splicing Single Mode Fibers, Fiber Alignment andJoint Loss-Multimode Fiber Joints, Single Mode Fiber Joints. Optical Sources- LEDs, Structures, Materials, Quantum Efficiency, Power, Modulation, Power Bandwidth Product, Injection Laser Diodes-Modes, Threshold Conditions, External Quantum Efficiency, Laser Diode Rate Equations, Resonant Frequencies, Reliability of LED& ILD.

Source to Fiber Power Launching: - Output Patterns, Power Coupling, Power Launching, Equilibrium Numerical Aperture, Laser Diode to Fiber Coupling

UNIT – IV

Optical Detectors: Physical Principles of PIN and APD, Detector Response Time, Temperature Effect on Avalanche Gain, Comparison of Photo Detectors, Optical Receiver Operation-Fundamental Receiver Operation, Digital Signal Transmission, Error Sources, Receiver Configuration, Digital Receiver Performance, Probability of Error, Quantum Limit, Analog Receivers.

UNIT – V

Optical System Design: Considerations, Component Choice, Multiplexing, Point-to- Point Links, System Considerations, Link Power Budget with Examples, Overall Fiber Dispersion in Multi-Mode and Single Mode Fibers, Rise Time Budget with Examples. Transmission Distance, Line Coding in Optical Links, WDM, Necessity, Principles, Types of WDM, Measurement of Attenuation and Dispersion, Eye Pattern.

TEXT BOOKS:

1 Optical Fiber Communications – Gerd Keiser, MC GRAW HILL EDUCATION, 4th Edition, 2008.
Optical Fiber Communications – John M. Senior, Pearson Education, 3rd Edition, 2009.

REFERENCE BOOKS:

1 Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner,Pearson Education, 2005.
2 Text Book on Optical Fibre Communication and its Applications – S.C.Gupta, PHI,2005.
Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.

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IV Year B.Tech. ECE- II Sem

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22EC861PE : MOBILE COMMUNICATIONS AND NETWORKS
Professional Elective – VI

Prerequisites: Analog and Digital Communications

Course Objectives:
1 To provide the student with an understanding of the cellular concept, frequency reuse, hand-off strategies.
2 To provide the student with an understanding of Co-channel and Non-Co-Channel interferences
3 To give the student an understanding of cell coverage for signal and traffic, diversity techniques and channel assignment
4 To give the student an understanding types of handoff.
5 To understand challenges and application of Adhoc wireless Networks

Course Outcomes: Up on completing this course ,the student will be able to:
1 Known the evolution of cellular and mobile communication system.
2 Explore the Co-Channel and Non-Co-Channel interferences
3 Known how to overcome the different fading effects?
4 Familiar with cell coverage for signal and traffic, diversity, techniques, frequency management, Channel assignment and types of handoff.
5 Demonstrate the difference between cellular and Adhoc Networks and design goals of MAC Layer protocol.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2			3	3			2		1	1	
CO2	2	2	2			1	3			1		1	1	
CO3	2	2	3			2	2			2		1	1	
CO4	1	1	1			3	3			2	1	2	1	
CO5	2	2	2	2	2	2	2	3		2		2	3	3

UNIT - I

Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone Systems. Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems. Uniqueness of Mobile Radio Environment-Fading-Tie Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in a Omni Directional Antenna System, System Capacity Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.

UNIT - II

Co-Channel Interference: Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and their effects, diversity techniques-space diversity, polarization diversity, frequency diversity, time diversity.

Non Co-Channel Interference: Adjacent Channel Interference, Near end far end interference, cross talk, effects on coverage and interference by power decrease, antenna height decrease, effects of cell site components.

UNIT - III

Cell Coverage for Signal and Traffic: Signal Reflections in flat and Hilly Terrain, effects of Human Made Structures, phase difference between direct and reflected paths, constant standard deviation,

Straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, path loss from a point to point prediction model in different conditions, merits of lee model.

Frequency Management and Channel Assignment: Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Sites and Mobile Units.

UNIT - IV

Handoffs and Dropped Calls: Handoff Initiation, types of Handoff, Delaying Handoff, advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem handoff, Introduction to Dropped Call Rates and their Evaluation.

UNIT - V

Ad Hoc Wireless Networks: Introduction, Cellular and Ad Hoc wireless Networks, Applications and Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet, MAC Protocols for Ad Hoc Wireless, Introduction, issues in designing AMAC Protocol for Ad Hoc wireless Networks, Design Goals of AMAC protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols.

TEXT BOOKS:

1 W.C.Y. Lee - Mobile Cellular Telecommunications, 2nd edition, Mc Graw Hill, 1989.
2 Theodore. S. Rapport - Wireless Communications, 2nd edition, Pearson Education, 2002.

REFERENCE BOOKS:

1 C. Siva ram Murthy and B.S. Manoj - Ad Hoc Wireless Networks: Architectures and Protocols, PHI, 2004.
2 Simon Haykin, Michael Moher - Modern Wireless Communications, Pearson Education, 2005.
3 Vijay Garg - Wireless Communications and Networking, Elsevier Publications, 2007.
4 Andrea Goldsmith -Wireless Communications-, Cambridge University Press, 2005.

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22EC862PE : PATTERN RECOGNITION AND MACHINE LEARNING
Professional Elective – VI

Prerequisite: Statistics and Linear Algebra

Course Objectives: The course objectives are
1 To understand the mathematical formulation of patterns.
2 To study the various linear models and various regressions
3 To understand machine learning techniques for data handling and to gain knowledge from it.
4 Understand the basic classifiers.
5 To learn how to differentiate between various models.

Course outcomes: Up on completing this course ,the student will be able to
1 Apply the Knowledge on setting hypothesis for pattern recognition of classes and functionality.
2 Construct the various linear models.
3 Design kernel methods and SVM for classification.
4 Develop machine independent, Markov and Mixed models.
5 Explore on tree based decision tree learning algorithm and its applications.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	2	2	-	-	2	-	2	3	2
CO2	3	2	2	2	2	2	2	-	-	2	-	2	3	2
CO3	3	2	2	2	2	2	2	-	-	2	-	2	3	2
CO4	3	3	2	2	2	2	2	-	-	2	-	2	3	2
CO5	3	3	2	2	2	2	2	-	-	2	-	2	3	2

UNIT- I

Introduction to Pattern recognition: Mathematical Formulation and Basic Functional Equation, Reduction of Dimensionality, Experiments in Pattern Classification, Backward Procedure for Both Feature Ordering- and Pattern Classification, Suboptimal Sequential Pattern Recognition, Nonparametric Design of Sequential Pattern Classifiers, Analysis of Optimal Performance and a Multiclass Generalization

UNIT- II

Linear Models: Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares , Sequential learning, Regularized least squares, Multiple outputs , The Bias-Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive, Equivalent, Bayesian Model Comparison, Probabilistic Generative Models- Continuous inputs, Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models -Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions

UNIT- III

Kernel Methods: Constructing Kernels, Radial Basis Function Networks - Nadaraya-Watson model, Gaussian Processes -Linear regression revisited, Gaussian processes for regression,

Learning the hyper parameters, Automatic relevance determination, Gaussian processes for classification, Laplace approximation, Connection to neural networks, Sparse Kernel Machines- Maximum Margin Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression, Computational learning theory, Relevance Vector Machines- RVM for regression, Analysis of sparsity, RVM for classification

UNIT- IV

Graphical Models: Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence- Three example graphs, D-separation, Markov Random Fields -Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, nference in Graphical Models- Inference

UNIT- V

Graphical Models: Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence- Three example graphs, D-separation, Markov Random Fields -Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, Inference in Graphical Models- Inference on a chain, Trees, Factor graphs, The sum-product algorithm, The max-sum algorithm, Exact inference in general graphs, Loopy belief propagation, Learning the graph structure.

TEXT BOOKS:

1 C. Bishop -Pattern Recognition and Machine Learning- -Springer, 2006.

2 Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall.

REFERENCE BOOKS:

1 Nils J. Nilsson -Introduction to machine learning, Stanford University Stanford.

2 William J. Deuschle – Undergraduate Fundamentals of Machine Learning, thesis Harvard College, Cambridge

3 Shai Shalev-Shwartz, Shai Ben-David- Understanding Machine Learning, From theory to Algorithms, Cambridge University press, 2014

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IV Year B.Tech. ECE- II Sem

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22EC863PE : WIRELESS SENSOR NETWORKS
Professional Elective – VI

Prerequisite: Analogue and Digital Communications

Course Objectives: The course objectives are
1 To acquire the knowledge about various architectures and applications of Sensor Networks
2 To understand issues, challenges and emerging technologies for wireless sensor networks
3 To learn about various routing protocols and MAC Protocols
4 To understand various data gathering and data dissemination methods
5 To Study about design principals, node architectures, hardware and Software required for implementation of wireless sensor networks.

Course Outcomes: Upon completion of the course, the student will be able to:
1 Apply the concepts of wsn in various applications
2 Analyze various architectures of Wireless Sensor Networks
3 Analyze various data gathering and data dissemination methods.
4 Design issues and challenges in wireless sensor networks
5 Design, Simulate and Compare the performance of various routing and MAC protocol

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1	2			3	3	2			1	1	1	
CO2						1	3	2				1	1	
CO3		2	3			2	2	2				1		
CO4		1	1			3	3	2			1	2		
CO5						2	2	3				2		

UNIT - I
Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

UNIT - II
Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

UNIT - III
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, BMAC protocol, IEEE 802.15.4 standard and ZigBee

UNIT - IV
Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT - V
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.
Single-node architecture, Hardware components & design constraints,
Operating systems and execution environments, introduction to TinyOS and nesC.

TEXT BOOKS:

1 Ad-Hoc Wireless Sensor Networks- C. Siva Ram Murthy, B. S. Manoj, Pearson
2 Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE

REFERENCE BOOKS:

1 Wireless Digital Communications – Kamilo Feher, 1999, PHI
2 Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3 Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
4 Wireless Communication and Networking – William Stallings, 2003, PHI.

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22EC831OE : MEASURING INSTRUMENTS
Open Elective (OE – III)

Course Objectives:
1 To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems.
2 To provide better familiarity with the concepts of Sensors and Measurements
3 To provide the knowledge of various measurement methods of physical parameters like velocity, acceleration, force, pressure and viscosity

Course Outcomes: Upon Completion of this course the student is
1 Apply concept of sensors and transducers for real time applications.
2 Translate theoretical concepts into working models.
3 Differentiate the measuring devices in various applications
4 Analyze the use of Gyroscopic in measuring physical quantity.
5 Differentiate various Measurements techniques used for Density and Viscosity

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2			3	3	2			1	1		
CO2	1	1				1	3	2				1		
CO3	2	2	3			2	2	2				1		
CO4	3	1	1			3	3	2			1	2		
CO5	2					2	2	3				2		

UNIT-I
Introduction to measurements:
Physical measurement, Forms and methods of measurements, Measurement errors, Statistical analysis of measurement data, Probability of errors, Limiting errors, Standards, Definition of standard units, International standards, Primary standards, Secondary standards, Working standards, Voltage standard, Resistance standard, Current standard, Capacitance standard, Time and frequency standards.

UNIT - II
Passive Sensors Resistive Sensors: Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers, Capacitive Sensors: Variable capacitor, Differential capacitor, Inductive Sensors: Reluctance variation sensors, Eddy current sensors

UNIT - III
Metrology: Measurement of length – Plainness – Area – Diameter – Roughness – Angle – Comparators – Gauge Blocks, Optical Methods for length and distance measurements. Velocity and Acceleration Measurement: Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods, Accelerometers- different types, Gyroscopes-applications.

UNIT - IV
Force and Pressure Measurement: Gyroscopic Force Measurement – Vibrating wire Force transducer. Basics of Pressure measurement –Manometer types – Force-Balance and Vibrating Cylinder Transducers – High- and Low-Pressure measurement

UNIT - V

Flow: Density and Viscosity Measurements: Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, Density measurements — Strain Gauge load cell method – Buoyancy method. Units of Viscosity, Two float viscorator –Industrial consistency meter

TEXT BOOKS:

1 Measurement Systems – Applications and Design – by Doeblin E.O., 4/e, McGraw Hill International, 1990.
2 Principles of Industrial Instrumentation – Patranabis D. TMH. End edition 1997.

REFERENCE BOOKS:

1 Sensor Technology Hand Book – Jon Wilson, Newne 2004
2 Instrument Transducers – An Introduction to their Performance and design – by Herman K.P. Neubrat, Oxford University Press
3 Measurement system: Applications and Design – by E.O. Doeblin, McGraw Hill Publications
4 Electronic Instrumentation by H.S. Kalsi.

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IV Year B.Tech. ECE- II Sem

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22EC832OE : COMMUNICATION TECHNOLOGIES
Open Elective (OE – III)

Course Objectives:

1 To give an overview of Source-Destination communication
2 To provide the different modes of communication technologies like wireless and cellular mobile networks.
3 To make familiar with the generations of communications like 1G, 2G, 3G, 4G and 5G.
4 To give brief explanation on security of network and its management

Course Outcomes: Up on completing this course ,the student will be able to

1 Use information theory principles to analyze the performance of communication systems.
2 Apply knowledge of principles of various wireless communication standards like GSM, Wi-Fi, and Satellite Communications etc.
3 Analyze the protocols and standards governing cellular network communications, such as GSM, CDMA, and LTE.
4 Analyze the performance metrics of Free Space Optical Communications systems.
5 Evaluate the effectiveness of different security measures like encryption algorithms, authentication methods in protecting against various cyber threats.

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	-	-	-	-	-	-	-	1	1	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1	1	1
CO3	2	3	3	2	-		-	-	-	-	-	1	1	1
CO4	3	2	2	2	-	-	-	-	-	-	-	1	1	1
CO5	3	2	2	2	-	-	-	-	-	-	-	1	1	1

UNIT - I:
Information Theory: Shanon Capacity, Multimedia Data, Data Processing, Boolean Logics, Information Content, Entropy, Source Coding, Channel Coding, Modulation Schemes, Internet

UNIT - II:
Wireless Communication Technologies: WLAN, Wifi, Bluetooth, Other Wireless PAN And WAN Technologies, Satellite Communications, Broadcast Services.

UNIT - III:
Cellular Mobile Networks: GSM(2G), UMTS (3G), LTE(4G), 5G Mobile Networks, Mobile Network Planning Aspects.

UNIT - IV:
Free Space Optical Communications: Optical Fiber, FTTC, FTTH, FTTBS, Free Space Optical Link, Channel Model with Different Factors, Deep Space Optical Communications.

UNIT - V:
Network Security and Management: Symmetrical Encryption, Asymmetrical Encryption, Authentication, Hash-Value, Integrity Check, Telecommunications Management Network, SNMP, Functionalities of Network Management, Trends and Future Development.

TEXT BOOKS:

1 Shun-Ping Chen, “Fundamentals of Information and Communication Technologies” 2020
2 B.P. Lathi, “Communication systems”- BS Publications, 2006.

REFERENCE BOOKS:

1 Simon Haykin, John Wiley “Digital Communications” 2005.
2 Herbert Taub, Donald L Schilling Gautham Saha “Principles of Communication systems” 3rd edition McGraw-Hill 2008.

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IV Year B.Tech. ECE- II Sem

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22EC833OE : FUNDAMENTALS OF SOCIAL NETWORKS
Open Elective (OE – III)

Course Objectives:
1 To give overview on social networks.
2 To make social media, information networks and world wide web concepts more familiar.
3 To provide knowledge on social network ties.
4 To provide knowledge on power laws related to information networks

Course outcomes: up on completing this course the students will be able to
1 Understand concepts like small-world experiment and snowball sampling related to social networks
2 Get knowledge on ties, weak ties and their strength
3 Know about structure of the web, modern web search, link analysis using hubs.
4 Acquire knowledge on power laws and analysis of Rich-get-Richer phenomena.
5 Distiguish various technologies in social networks

	PROGRAMME OUTCOMES													
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2			3	3	2			1	1		
CO2						1	3	2				1		
CO3	3	2	3			2	2	2				1		
CO4	1	1	1			3	3	2			1	2		
CO5						2	2	3				2		

UNIT - I:
Introduction to social networks: The Empirical Study of Social Networks, Interviews and Questionnaires, Direct Observation, Data from Archival or Third-Party Records, Affiliation Networks, The Small-World Experiment, Snowball Sampling, Contact Tracing, and Random Walks.

UNIT - II:
Graph theory and Social Networks: Basic definitions, Paths and Connectivity, The strength of weak ties, Tie Strength and Network Structure in Large-Scale Data, Tie strength, social media, passive engagement

UNIT - III:
Information networks and World Wide Web: The World Wide Web, Information Networks, Hypertext, and Associative Memory, The Web as a Directed Graph, The Bow-Tie Structure of the Web, the emergence of web 2.0, Searching the Web: The Problem of Ranking Link Analysis using Hubs and Authorities, PageRank, Applying Link Analysis in Modern Web Search**.**

UNIT - IV:
Power Laws and Rich-Get-Richer Phenomena: Popularity as a Network Phenomenon, Power Laws, Rich-Get-Richer Models, The Unpredictability of Rich-Get-Richer Effects, The Long Tail, The Effect of Search Tools and Recommendation Systems, Advanced Material: Analysis of Rich-Get-Richer Processes.

UNIT - V:
The Small-World Phenomenon: Six Degrees of Separation, Structure and Randomness,

Decentralized Search, Modeling the Process of Decentralized Search, Empirical Analysis and Generalized Models, Core-Periphery Structures and Difficulties in Decentralized Search, Advanced Material: Analysis of ecentralized
Search.

TEXT BOOKS:

1 M. E. J. Newman "Networks an introduction" Oxford University Press 2010
2 Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010.

REFERENCE BOOKS:

1 Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.
2 Maksim Tsvetovat and Alexander Kouznetsov. "Social Network Analysis for Startups". O'Reilly Media, 2011.

Program Educational Objectives (PEO's):

PEO1: The students of the program will have strong foundation in the fundamental principles and gain advanced knowledge in the Basic Sciences, Mathematics and other application of Advanced Computer Engineering.

PEO2: The students of the program will be prepared for their successful careers in the software industry / seek higher studies and continue to develop.

PEO3: The students of the program will prepare to engage in professional development through self-study, graduate and professional studies in engineering & business.

PEO4: Graduates shall have good communication skills, leadership skills, professional, ethical and social responsibilities.

Programme Outcomes (PO's) :

PO1. Engineering knowledge: Ability to obtain and apply the knowledge of science and engineering essentials in problem solving.

PO2. Problem Analysis: Ability to undertake problem recognition ,formulation and providing ideal solution.

PO3. Design/ development of solutions: An ability to design, implement a computer based system, with desire program to meet the needs of social and environmental considerations.

PO4. Conduct investigations of complex problems: An ability to apply mathematical formulas, algorithmic principles and computational theory to develop a model and design of computer based system.

PO5. Modern tool usage: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PO6. Engineer and society: An ability to analyze the impact of computing in different organizations, society including the varying policy issues that are taken care off.

PO7. Environment and sustainability: Understanding of impact of engineering solutions on the environment and this attains sustainability with responsibility.

PO8.Ethics: An ability to lead a strong professionalism and the ethical values.

PO9. Individual and team work: An ability to function effectively on multidisciplinary environments leads to leadership and member of team work.

PO10. Communication: An ability to communicate effectively in both verbal and written form which enables to prepare well documentation for report writing and a project.

PO11. Project management and finance: Apply project management practices to the launch of new programs, initiatives, products, services, and events relative to the stakeholder needs including – finance.

PO12. Life-long learning: Recognition of the need for higher studies and inspires to update the latest technologies by the way of life long learning process from time to time.

Program Specific Outcomes: (PSO's):

PSO1: Demonstrate proficiency in use of software and hardware required to practice electronics and communication profession

PSO2: To exhibit the ability to design and develop complex systems in the areas of IoT based Embedded Systems, Advanced Signal and Image Processing.

Institutes Under

TKR EDUCATIONAL SOCIETY

Teegala Krishna Reddy Engineering College(TKEM)

TKR College of Engineering and Technology(TKRC)

TKR Institute of Management and Science(TKRB)

TKR College of Pharmacy(TKRP)