FOREWORD

CMR Technical Campus, established in the year 2009, Approved by AICTE, New Delhi, Permanently Affiliated to JNTUH, twice Accredited by NBA and has been bestowed with NAAC 'A' Grade of 3.12 score on 04 scale in February 2019 for its remarkable academic accomplishments accompanied by its unflinching spirit and dedication to impart quality technical education to the deserving aspirants. The institution has commenced functioning independently within the set norms prescribed by UGC and AICTE. The performance of the institution manifests the confidence that the prestigious monitoring body, the UGC has on it, in terms of upholding its spirit and sustenance of the expected standards of functioning on its own consequently facilitating the award of degrees for its students. Thus, an autonomous institution is provided with the necessary freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

CMR Technical Campus takes pride for having won the confidence of such distinguished academic bodies meant for monitoring the quality in technology education. Besides, the institution is delighted to sustain the same spirit of discharging the responsibilities that it has been conveying since a decade to attain the current academic excellence, if not improving upon the standards and ethics. Consequently, statutory bodies such as the Academic Council and the Boards of Studies have been constituted under the supervision of the Governing Body of the College and with the recommendations of the JNTU Hyderabad, to frame the regulations, course structure and syllabi for autonomous status.

The autonomous regulations, course structure and syllabi have been framed in accordance with the vision and mission of the institution along with certain valuable suggestions from professionals of various ancillary fields such as the academics, the industry and the research, all with a noble vision to impart quality technical education and contribute in catering full-fledged engineering and management graduates to the society.

All the faculty members, the parents and the students are requested to study all the rules and regulations carefully and approach the Director to seek any clarifications, if needed, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the institution and for brightening the career prospects of engineering and management graduates.

DIRECTOR

CMR TECHNICAL CAMPUS

Vision:

To impart quality education in serene atmosphere thus strive for excellence in Technology and Research.

Mission:

- To create state of art facilities for effective Teaching – Learning process.
- Pursue and Disseminate knowledge based research to meet the needs of Industry & Society.
- Infuse Professional, Ethical and Societal values among Learning Community.

Quality Policy:

- The management is committed in assuring quality service to all its stakeholders like parents, students, alumni, employees, employers and the community.
- Continual quality improvement by establishing and implementing mechanisms and modalities.
- Transparency in procedures and access to information and actions.

Core Values:

The CMR Technical Campus is guided by the following core values in delivering its mission and pursuing its vision.

- **A**ccountability: Demonstrate responsibility for our actions; establish and communicate clearly defined and articulated goals and objectives.
- **B**enchmark: To develop and pursue high standards by encouraging skill development and entrepreneurship to meet industry and society needs.
- **C**ommitment: Focus on students and stakeholders needs; continuously evaluate and improve academics, research and infrastructure.
- **D**ignity: Recognize the expertise of all members of the institute and encourage individual contribution and also include stakeholders in the decisions that affect them.

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
Kandlakoya (V), Medchal Road, Hyderabad–501401, Telangana State (India)

Academic Regulations [R20]
B.Tech. - Regular Four Year Degree Programme
(For students admitted from the academic year 2020 - 21)
&
B.Tech. - Lateral Entry Scheme
(For students admitted from the academic year 2021 - 22)

CMR Technical Campus (CMRTC) offers a 4-year (8 semesters) Bachelor of Technology (B.Tech.) degree programme, under Choice Based Credit System (CBCS).

1.   UNDER GRADUATE PROGRAMS OFFERED (E & T)

       CMRTC (Autonomous), affiliated to JNTUH, offers 4 Year (8 Semesters) **B.Tech.** Degree Programme in the following Branches of Engineering:

1) Civil Engineering
2) Mechanical Engineering
3) Electronics and Communication Engineering
4) Computer Science and Engineering
5) Information Technology
6) Computer Science and Engineering (Artificial Intelligence and Machine Learning)
7) Computer Science and Engineering (Data Science)
8) Artificial Intelligence and Machine Learning
9) Computer Science and Design

2.   ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION

2.1.   Admission into first year of four year B.Tech. (Regular) Degree Programme:

2.1.1.   Eligibility: A candidate seeking admission into the first year of four year B. Tech. Degree Programme should have:

(i)   Passed either Intermediate Public Examination (IPE) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.

(ii)   Secured a rank in the TSEAMCET examination conducted by TSCHE for allotment of a seat by the Convenor, TSEAMCET.

2.1.2.   Admission Procedure: Admissions are made into the first year of four year B.Tech. Degree Programme as per the stipulations of the TSCHE.

(a)   Category A: 70% of the seats are filled through TSEAMCET counseling.
(b)   Category B: 30% of the seats are filled by the Management.

2.2.   Admission into the second year of four-year B. Tech. (Regular) Degree Programme Under Lateral Entry Scheme.

2.2.1   Eligibility: A candidate seeking admission into the II year I Semester B. Tech. Regular Degree

Programme under Lateral Entry Scheme (LES) should have passed the qualifying examination (B.Sc. Mathematics or Diploma in concerned course) and have secured a rank at Engineering

Common Entrance Test TSECET (FDH). Admissions are made in accordance with the instructions received from the Convenor, TSECET and Government of Telangana State.

2.2.2   **Admission Procedure:** Admissions are made into the II year of four year B.Tech. (Regular) Degree Programme through Convenor, TSECET (FDH) against the sanctioned intake in each Programme of study as lateral entry student.

2.3.   **Branch Transfers:** There shall be no Branch transfers after the completion of Admission Process.

2.4.   **Medium of Instruction:** The Medium of Instruction and Examinations for the entire B.Tech. programme will be in **English** only.

3.   B.Tech. PROGRAMME STRUCTURE

3.1   **Admitted under Four year B. Tech. (Regular) degree Programme:**

3.1.1   A student after securing admission shall pursue the under graduate programme in B.Tech for a minimum period 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, students shall forfeit their seat in B.Tech course.

3.1.2   As per AICTE guidelines, a 3-week mandatory **"Induction Programme"** shall be offered to I - B.Tech newly admitted students to get acquainted with the professional environment and prepare them for the academic schedules ahead.

3.1.3   The entire B.Tech. programme is structured for a total of 160 credits. Distribution of credits Semester-wise is available in the respective course structure.

3.1.4   Each student shall register and secure 160 credits (with CGPA $\geq$ 5) for the completion of the under graduate programme and award of the B.Tech degree.

3.2   **Admitted under Lateral Entry Scheme (LES) into B. Tech. degree Programme:**

3.2.1   After securing admission into II year B.Tech. I Semester, the LES students shall pursue a course of study for not less than three academic years (6 Semesters) and not more than six academic years (12 Semesters), failing which students shall forfeit their seat in B.Tech. programme.

3.2.2   The student shall register and secure 120 credits (with CGPA $\geq$ 5) from II year to IV year B.Tech. programme (LES) for the award of B. Tech degree.

3.3   The Course Structure is organized based on the AICTE Model Curriculum (Jan-2018) for Under-Graduate Degree Courses in Engineering & Technology. **UGC / AICTE** specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations / Norms, which are listed below:

3.3.1   **Semester Scheme:**
The evaluation of course is on the basis of Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC while the course Curriculum / Course Structure is as suggested by AICTE.

- B.Tech. (Regular) Programme is of 4 Academic Years (8 Semesters)
- B.Tech. (LES) Programme is of 3 Academic Years (6 Semesters),
- Each academic year is divided into two semesters
- Each semester is of 22 weeks ($\geq$ 90 Instructional days per semester)
- Each Semester is having - 'Continuous Internal Evaluation (CIE)' and 'End Semester Examination (ESE).

3.3.2 Credit Courses:

a) All Subjects / Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject / Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods : Credits) Structure based on the following general pattern:

Theory		Practical	
1 Hr. Lecture (L)	1 credit	1 Hr. Practical (P)	0.5 credit
1 Hr. Tutorial (T)	1 credit	2 Hrs Practical (Lab)	1.0 credit

All Mandatory Courses, Study Tour, Guest Lecture, etc., will not carry any Credits.

b) **Contact Hours:** Weekly contact hours – maximum of 30 hours per week (1 hour = 60 Minutes) including credit and non-credit courses.

3.3.3 Subject / Course Classification:

CMRTC has followed the guidelines specified by AICTE / UGC / JNTUH. The subjects / courses offered in B.Tech. programme are broadly classified as mentioned below.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses	BS – Basic Sciences	Includes mathematics, physics and chemistry subjects
2		ES - Engineering Sciences	Includes fundamental engineering subjects
3		HS – Humanities and Social sciences	Includes subjects related to humanities, social sciences and management
4	Core Courses	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	PR- Project Work	B.Tech. project or UG project or UG major project or Project Stage I & II
8		Industrial training/ Mini- project	Industrial training/ Summer Internship Industrial Oriented Mini-project/ Mini-project
9		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor courses	-	1 or 2 Credit courses (subset of HS)
11	Mandatory Courses	MC	Mandatory courses (non-credit)
12	Audit Courses	AC	

3.3.4   Subject Code Nomenclature:

1	2	3	4	5	6	7	8	9

1, 2 - Year of implementation of Regulation
3, 4 - Department Code (Course offering department)
5 - Serial No. of Semester (1 to 8)
6, 7 - Serial No. of Subject, Semester wise
8, 9 - Course Group/ Category

Example: - 19EC302PC

4.   COURSE REGISTRATION

4.1   A '**Faculty Advisor/Mentor**' shall be assigned to each student to advise the student about the B.Tech. programme, course structure and curriculum, choice / option for subjects / courses, based on his/her 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 online submission, ensuring '**date** and **time stamping**'. The online registration requests for any 'current semester' shall be completed **before the commencement of ESEs (End Semester Examinations) of the 'preceding semester'**.

4.3   A student can apply for **online** registration, **only after** obtaining the '**written approval**' from his faculty advisor or Mentor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor and the student.

4.4   A student has to register for all subjects/courses in a semester as specified in the course structure and may be permitted to register one additional theory subject / course limited to 3 credits, based on the student's **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   If the student submits ambiguous choices or multiple options or erroneous (incorrect) entries during **online** 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.

4.6   Subject / course options exercised through **online** 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 Head of the Department in a semester could not be offered due to any unforeseen 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), which may be considered. Such alternate arrangements will be made by Head of the Department, with due notification and time-framed schedule, within the **first week** from the commencement of class-work for that semester.

4.7   Dropping of additional registered subject / course (refer 4.4) may be permitted only after obtaining prior approval from the faculty advisor / Mentor, '**within a period of 15 days**' from the commencement of that semester.

4.8   **Open electives**: Students can choose open electives, wherever offered, from the list of open electives given for their stream. However, student has to opt for at least one HS Open elective and cannot opt for an open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

4.9   **Professional electives**: Students have to choose professional elective, wherever offered, from the list of professional electives given. However, students may opt for professional

elective subjects offered in the related area.

4.10   **Mandatory Courses (Non-Credit):** All mandatory courses, wherever offered, require prior registration.

5.   SUBJECTS / COURSES TO BE OFFERED

5.1   A typical Section (or Class) Strength for each Semester shall be 60. A subject / course may be offered to the students, **if only** a minimum 1/3 of students register to the course. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

i)   More than **one faculty member** may offer the **same subject** (lab / practical's may be included with the corresponding theory subject in the same semester) in any semester.

ii)   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 s tudent).

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

6.   ATTENDANCE REQUIREMENTS

6.1   A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum 75% of attendance in aggregate (excluding the days of midterm examinations) for all the subjects / courses, excluding attendance in mandatory courses in that semester.

6.2   Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be granted 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 towards 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. They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case 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.   ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied, in addition to the attendance requirements 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% marks (24 out of 70 marks) in the End Semester Examination (ESE), and a minimum of 40% of marks (40 out of 100) in the sum total of the Continuous Internal Evaluation (CIE) and End Semester Examination (ESE) 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 summer internship and project courses, if student secures not less than 40% of the total marks in each of them. The student would be treated as failed, if student does not submit a report on his project(s), or does not make a presentation of the same before the evaluation committee as per the schedule. Student may reappear once for each of the above evaluations, when they are scheduled again; if he fails in such 'one re-appearance' evaluation also, student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3   Promotion Rules

7.3.1   B.Tech. (Regular):

S. No.	Promotion	Conditions to be fulfilled
1	First Semester to Second Semester	Regular course of study of First Semester
2	Second Semester to Third Semester	**(i)** Regular course of study of Second Semester Must have secured at least 50% credits (20 out of 40 credits) up to Second Semester from all the relevant regular and supplementary examinations whether the student takes those examinations or not.
3	Third Semester to Fourth Semester	Regular course of study of Third Semester
4	Fourth Semester to Fifth Semester	**(i)** Regular course of study of Fourth Semester Must have secured at least 60% credits (48 out of 80 credits) up to Fourth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fifth Semester to Sixth Semester	Regular course of study of Fifth Semester
6	Sixth Semester to Seventh Semester	**(i)** Regular course of study of Sixth Semester Must have secured at least 60% credits (72 out of 120 credits) up to Sixth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Seventh Semester to Eighth Semester	Regular course of study of Seventh Semester

7.3.2   B. Tech - Lateral Entry Scheme (LES):

S. No.	Promotion	Conditions to be fulfilled
1	Third Semester to Fourth Semester	Regular course of study of Third Semester
2	Fourth Semester to Fifth Semester	**(i)** Regular course of study of Fourth Semester Must have secured at least 50% credits (20 out of 40 credits) up to Fourth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Fifth Semester to Sixth Semester	Regular course of study of Fifth Semester
4	Sixth Semester to Seventh Semester	**(i)** Regular course of study of Sixth Semester Must have secured at least 60% credits (48 out of 80 credits) up to Sixth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Seventh Semester to Eighth Semester	Regular course of study of Seventh Semester

7.4   A student has to register for all subjects covering 160 credits (120 credits in case of LES) as specified and listed (with the relevant course / subject classifications as mentioned) in the course structure, fulfill all the attendance and academic requirements for 160 credits (120 credits in case of LES) securing a minimum of **'C'** grade or above in each subject, and 'earn all 160 credits (120 credits in case of LES) securing SGPA $\geq$ 5.0 (in each semester), and CGPA (at the end of each successive semester) $\geq$ 5.0, to successfully complete the under graduate programme.

7.5   If a student registers for '**additional subjects'** (in the parent department or other departments / branches of engineering) other than those listed subjects totaling to 160 credits (120 credits in case of LES) as specified in the course structure of parent department, the performances in those '**additional subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits (120 credits in case of LES)) will not be taken into account while calculating the SGPA and CGPA. For such '**additional subjects'** registered, % of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1 to 7.4 above.

7.6   A student eligible to appear in the End Semester Examination for any subject / course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for 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 ESE 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 when the same semester is offered in the next academic year for fulfillment of academic requirements**. The academic regulations under which student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which 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 academic credits.** The academic regulations under which student has been readmitted shall be applicable.

8.   EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

8.1   The performance of a student in each semester shall be evaluated subject-wise / course-wise (irrespective of credits assigned) with a maximum of 100 marks. These evaluations shall be based on 30 marks allotted for CIE (Continuous Internal Evaluation) and 70 marks for ESE (End Semester Examination), and a letter grade corresponding to the percentage of marks obtained shall be given.

8.2   Evaluation of Theory Subjects / Courses

A)   **Continuous Internal Evaluation:** For each theory subject, during the semester, there shall be 2 Mid-term examinations of 30 marks each. Each Mid-term examination consists of subjective paper for 25 marks & assignment for 5 marks and the final CIE marks (for total of 30) are calculated by taking average of the two Mid-term examinations.

- The first Mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

- The subjective paper shall be conducted for duration of 90 minutes. Each subjective paper shall contain 2 parts (Part-A and Part-B). Part-A consists of one compulsory question with five sub questions carrying two marks each. Part-B consists of three questions carrying 5 marks each (may contain sub questions) with internal choice; the

student has to answer all the questions.

- First assignment should be submitted before the commencement of the first mid-term examinations, and the second assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified / given by the concerned subject teacher.

B) **End Semester Examinations:** The duration of ESE is 3 hours. The details of the question paper pattern is as follows:

- The end semester examinations will be conducted for 70 marks consisting of two parts viz. i) **Part- A** for 20 marks, ii) **Part - B** for 50 marks.

- Part-A is compulsory, which consists of one question with ten sub questions (two from each unit) carrying 02 Marks each.

- Part-B consists of five questions (numbered from 02 to 11) carrying 10 marks each. One question from each unit (may contain sub-questions) with internal choice.

8.3   **Evaluation of Practical Subjects / Courses:** In any semester, a student has to complete at least 08 to 10 experiments / exercises in each laboratory course and get the record certified by the Subject teacher and concerned Head of the Department to be eligible for End Semester Examination.

For practical subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks and 70 marks for End Semester Examination (ESE).

A)   **Continuous Internal Evaluation (CIE):** Out of the 30 marks, 15 marks are allocated for day-to-day work evaluation and the remaining 15 marks for internal practical examination. There shall be two internal practical examinations of 15 marks each conducted by the concerned laboratory teacher and the average of the two is considered.

B)   **End Semester Examination (ESE):** The ESE for practical subject / course shall be conducted at the end of the semester with duration of 3 hours by one internal and one external examiner appointed by the Head of the Institution as per the recommendation of the concerned Head of the Department.

8.4   **Evaluation of Design / Drawing Subjects / Courses:** For the subjects such as Engineering Graphics, Machine Drawing, Production drawing and any such subject, the distribution shall be 30 marks for CIE (15 marks for day-to-day work and 15 marks for Mid-Term examination) and 70 marks for ESE.

A) **Continuous Internal Evaluation:** There shall be two Mid-Term examinations in a Semester and the Marks for 15 can be calculated taking average of the two Mid-term examinations and these are added to the marks obtained in day to day work evaluation.

B) **End Semester Examinations:** The duration of ESE is 03 hours consisting of five questions carrying 14 marks each. One question from each unit (may contain sub-questions) with internal choice.

8.5   **Evaluation of Summer Internship:** The Summer internship (02 - 04 weeks) registered by the students in consultation with course coordinator and carried out in Industries and/or R&D Organizations immediately after their VI semester course work. The completion report will be assessed in VII semester for 'Satisfactory' or 'Unsatisfactory' by a committee consisting of Head of the Department, supervisor and a senior faculty member of the department.

8.6   **Evaluation of Project work:** Student(s) shall start the Project Work during the VII Semester

(IV-B.Tech.–I–Semester) as per the instructions of the Project Guide / Project Supervisor assigned by the Head of the Department. The topics for Summer Internship, Project Stage – I and Technical seminar shall be different from one another.

a) The Project Work shall be carried out in two stages: Project-I (Stage – I) during VII Semester (IV-B.Tech.–I–Semester), and Project-II (Stage – II) during VIII Semester (IV-B.Tech.–II–Semester), and the student has to prepare two independent Project Work Reports – *one each during each stage*. First Report shall include the Project Work carried out under Stage – I, and the Second Report (Final Report) shall include the Project Work carried out under Stage – I and Stage – II put together. Stage – I and Stage – II of the Project Work shall be evaluated for 100 marks each.

b) Out of the total 100 marks allotted for each stage of the Project Work, 30 marks shall be for the Continuous Internal Evaluation(CIE), and 70 marks shall be for the End Semester Viva-voce Examination (ESE). The marks earned under CIE for both the stages of the Project shall be awarded by the Project Guide / Supervisor (based on the continuous evaluation of student's performance during the two Project Work stages); and the marks earned under ESE shall be awarded by the Project Viva-voce Committee / Board (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).

c) For the Project Stage - I, the Viva-voce shall be conducted at the end of the VII Semester, before the commencement of the End semester Examinations, by the Project Evaluation Committee comprising of the Head of the Department or One Senior Faculty member and Supervisor and the Project Stage – II Viva-voce shall be conducted by the Committee comprising of an External Examiner appointed by the Head of the Institution, Head of the Department and Project Supervisor at the end of the VIII Semester, before the commencement of the End Semester Examinations.

d) If a student does not appear (or fails) for any of the two Viva-voce examinations at the scheduled times as specified above, he may be permitted to reappear for Project Stage - I and/or Project Stage - II Viva-voce examinations, as and when they are scheduled again in that semester; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester(s), as and when they are scheduled, as supplementary candidate.

8.7   **Evaluation of Technical Seminar:** The student has to enroll and get approval for technical seminar on a specialized topic from the concerned advisor / Mentor in the beginning of VII semester (IV year I semester). The student should collect the information on a specialized topic, prepare a technical report, give seminar presentation on the topic and submit it to the department as notified by the concerned Head of the Department. It shall be evaluated by the departmental evaluation committee consisting of Head of the Department, seminar supervisor and two senior faculty members. The seminar report and the seminar presentation shall be evaluated for 100 marks. There shall be no End Semester Examination for the seminar.

8.8   **Evaluation of Mandatory Non-Credit Courses:** There shall be only CIE for all mandatory (non-credit) courses, instead of marks or letter grade. '**Satisfactory**' or "**Unsatisfactory**' shall be indicated and this will not be counted for the computation of SGPA / CGPA. The student has to maintain a minimum of 65% attendance and secure not less than 40% in the CIE and then only the student is declared as **pass** and will be qualified for the award of the degree.

8.9   **MOOCs Courses through SWAYAM Portal:** The approved list of SWAYAM courses shall be notified and made available at the beginning of the semester. The students are given option to choose Professional Electives / Open Electives in the curriculum offered by the institute or from the notified list. The maximum number of transferable credits through SWAYAM Courses are capped at 18 (06 Courses).

9.   GRADING PROCEDURE

9.1   Grades will be awarded to indicate the performance of the student in each theory subject, lab / practical's, design/drawing practice, Summer Internship, Technical Seminar and Project-I & Project-II based on the percentage of marks obtained in Continuous Internal Evaluation plus End Semester Examination, both taken together, as specified in item 8 above, a corresponding letter grade shall be given.

9.2   As a measure of the student's performance, a 10-point Absolute Grading System using the following letter grades (UGC Guidelines) and corresponding percentage of marks shall be followed.

% of Marks Secured (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above ($\geq 90\%$, $\leq 100\%$)	O (Outstanding)	10
Below 90% but not less than 80% ($\geq 80\%$, $< 90\%$)	A$^+$ (Excellent)	9
Below 80% but not less than 70% ($\geq 70\%$, $< 80\%$)	A (Very Good)	8
Below 70% but not less than 60% ($\geq 60\%$, $< 70\%$)	B$^+$ (Good)	7
Below 60% but not less than 50% ($\geq 50\%$, $< 60\%$)	B (above Average)	6
Below 50% but not less than 40% ($\geq 40\%$, $< 50\%$)	C (Average)	5
Below 40% ($< 40\%$)	F (Fail)	0
Absent	AB	0

9.3   A student obtaining **F** grade or **AB** grade in any subject shall be considered **'failed'** in that subject and will be required to reappear in '**Supplementary Exam**' in the End Semester Examination (ESE), as and when offered. In such cases, Continuous Internal Examination (CIE) in those subject(s) will remain same as those obtained earlier.

9.4   A letter grade does not imply any specific % of marks.

9.5   In general, a student shall not be permitted to repeat any subject/course (s) only for the sake of '**grade improvement**' or 'SGPA / CGPA improvement'. However, student has to repeat all the subjects / courses pertaining to that semester, if detained.

9.6   A student earns grade point (GP) in each subject / course, on the basis of the letter grade obtained in that subject/course (excluding mandatory non-credit courses). Then 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

9.7   The 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 (ΣCP) 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** decimal places. SGPA is thus computed as

SGPA $(S_i) = \sum (C_i \times G_i) / \sum C_i$

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

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 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, I semester onwards, at the end of each semester, as per the formula:

$$\text{CGPA} = \sum (C_j \times S_i) / \sum C_j$$

where S_i is the SGPA of the jth semester and C_j is the total number of credits in that semester.

Illustration of calculation of SGPA					Illustration of calculation of CGPA			
Course /Subject	Credits	Letter Grade	Grade Points	Credit Points	Sem.	Credits	SGPA	Credits x SGPA
Course 1	4	A	8	4 x 8 = 32	Sem I	19	7	19 x 7= 133
Course 2	3	O	10	3 x 10 = 30	Sem II	19	6	19 x 6= 114
Course 3	3	C	5	3 x 5 = 15	Sem III	21	6.5	21 x 6.5 =136.5
Course 4	3	B	6	3 x 6 = 18	Sem IV	21	6	21 x 6 = 126
Course 5	1.5	A+	9	1.5x9 = 13.5	Sem V	21	7.5	21 x 7.5 =180
Course 6	1.5	A	8	1.5x8 = 12	Sem VI	21	8	21 x 8 = 157.5
Course 7	1.5	B+	7	1.5x7 = 10.5	Sem VII	21	8.5	21 x 8.5 =178.5
Course 8	1.5	A+	9	1.5x9 = 13.5	Sem VIII	17	8	17 x 8 = 136
Total	**19**		**62**	**144.5**	**Total**	**160**		**1161.5**
SGPA = 144.5/19 = 7.60					**CGPA = 1161.5/160 = 7.26**			

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   For calculations listed in Item 9.6–9.9, performance in failed subjects/courses (securing **F** grade) will also be taken into account, and the credits of such subjects/courses will also be included in the multiplications and summations. However, mandatory courses will not be taken into consideration.

10   PASSING STANDARDS

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

10.2   After the completion of semester, a grade card or grade sheet (or transcript) 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.), credits earned, SGPA, and CGPA.

11   DECLARATION OF RESULTS

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

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

Percentage of Marks = (final CGPA – 0.5) x 10

12   AWARD OF DEGREE

12.1   After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. degree the student shall be placed in one of the following four classes based on CGPA:

Class Awarded	Grade to be Secured	Remarks

First Class with Distinction	≥ 8 CGPA	From the aggregate marks secured from 160 Credits for Regular Students and 120 Credits for Lateral Entry Students.
First Class	≥ 6.5 to < 8 CGPA	
Second Class	≥ 5.5 to < 6.5 CGPA	
Pass Class	≥ 5.00 to < 5.5 CGPA	
FAIL	CGPA < 5	

12.2   First class with distinction will be awarded to those students who clear all the subjects during his / her regular course of study by fulfilling the following conditions:

(i)   Should have passed all the subjects/courses within the first 4 academic years (or 8 sequential semesters) for B.Tech. (Regular) and first 3 academic years (or 6 sequential semesters) for B.Tech. (LES) from the date of commencement of first year first semester for B.Tech. (Regular) and II year I semester for B.Tech. (LES).

(ii)   Should have secured a CGPA ≥ 8.00, at the end of each of the 8 sequential semesters (6 sequential semesters for LES), starting from I year I semester (starting from II year I semester for LES) onwards.

(iii) Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason, shall be placed in '**first class with distinction**'.

A Student not fulfilling any of the above condition and having final CGPA ≥ 8.00 shall be placed in "First Class".

12.3   **B. Tech (Honors):** The student who accrue 20 credits from NPTEL in addition to their regular course work, will be awarded with Honors Degree.

12.4   **Award of Medals:** Students fulfilling the conditions listed under item 12.2 alone will be eligible for award of '**College Ranks**' and '**Medals**'.

12.5   **Graduation Day:** The College shall have its own Annual Graduation Day for the award of Degrees issued by the University.

12.6   **Transcripts:** After successful completion of prerequisite credits for the award of degree a transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

13   WITHHOLDING OF RESULTS

If the student has not paid the fees to the Institute 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   SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for odd semester subjects will be conducted along with even semester regular examinations and vice versa.

15.   TRANSITORY REGULATIONS

a)   A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the degree programme, may be considered eligible for readmission to the same subjects / courses (or equivalent subjects/ courses, as the case may be), and same professional electives / open electives (or from set / category of electives or equivalents

suggested, as the case maybe) as and when theyare offered (within the time-frame of 8 years fromthedate of commencement of student's first yearfirst semester).

b) A student who has failed in any subject under any regulation has to pass those subjects in the respective regulations.

c) 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 R19 Regulations. The performance evaluation of the student will be done as per the rules and regulations applicable at the time of admission(s) regarding award of grade and/or class as the case may be.

d) If a student readmitted to R19 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R19 Regulations will be substituted by another subject to be suggested by the CMRTC Academic Council.

e) **Promotion Rule:** Where the credits allotted to a semester/year under the regulations studied in are different from that under R19 regulations for the corresponding semester/year, the promotion rules of R19 vide section 7.3 shall be applied after normalization. Normalization is done by scaling down or up the number of credits of a semester/year under the previous regulations to equal the number of credits of the corresponding semester/year under R19 regulations and revising the secured credits also in the same proportion.

16 STUDENT TRANSFERS

There shall be no transfers from other colleges / streams.

17 RULES OF DISCIPLINE

17.1 Any attempt by any student to influence the teachers, examiners, faculty members and staff of Controller of Examination office for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice case and the student can be debarred from the college.

17.2 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, student is awarded zero marks in that subject(s).

17.3 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Malpractice Prevention Committee is final.

18. MALPRACTICE

18.1 Malpractice Prevention Committee: The committee shall examine the student's malpractice and indiscipline cases occurred, while conducting the examinations and recommend appropriate punishment to the Academic Council after taking explanation from the student and concerned invigilator as per the malpractice rules mentioned below. The committee consists of

a) Controller of Examinations - Chairman
b) Addl. Controller of Examinations.- Convener
c) Subject Expert - Member
d) Head of the Department of which the student belongs to - Member
e) The Invigilator concerned - Member

18.2 Malpractice Rules: Disciplinary Action for Improper Conduct in Examinations

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

	during or after the examination.	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 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 Controller of examinations / 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 addl. Controller of examinations 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 addl. Controller of examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all 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 Chief Superintendent for further action to award suitable punishment.	

19. SCOPE

i) Wherever the words 'he, him, his' occur in the regulations, they shall include 'she, her'.

ii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

iii) The above mentioned rules and regulations are applicable in general to both B.Tech. (Regular) and B.Tech. (LES), unless and otherwise specific.

iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Committee is final.

20. REVISION AND AMENDMENTS TO REGULATIONS

The Academic Council may revise 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 Academic Council.

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CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B.Tech. I Year Syllabus

Common for ECE & CSE (DS)

I SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	20MA101BS	Algebra and Calculus	3	1	0	4
2	20AP102BS	Applied Physics	3	1	0	4
3	20EC103ES	Basic Electrical & Electronics Engineering	3	1	0	4
4	20ME104ES	Engineering Graphics	2	0	4	4
5	20AP105BS	Applied Physics Lab	0	0	3	1.5
6	20EC106ES	Basic Electrical & Electronics Engineering Lab	0	0	3	1.5
7	20EC107ES	Basic Elements of Engineering Technology	0	0	2	1
8	20MC108ES	Environmental Science	3	0	0	0
		Induction Programme				
		Total Credits	**14**	**3**	**12**	**20**

II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	20MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2	20CH202BS	Engineering Chemistry	3	1	0	4
3	20CS203ES	Programming for problem solving	3	1	0	4
4	20EN204HS	English	2	0	0	2
5	20ME205ES	Engineering Workshop	0	0	3	1.5
6	20CH206BS	Engineering Chemistry Lab	0	0	3	1.5
7	20EN207HS	English Language and Communication Skills Lab	0	0	3	1.5
8	20CS208ES	Programming for problem solving Lab	0	0	3	1.5
		Total Credits	**11**	**3**	**12**	**20**

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B.Tech. II Year Syllabus

ECE

III SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	20EC301PC	Electronic Devices and Circuits	3	0	0	3
2	20EC302PC	Digital System Design	3	0	0	3
3	20EC303PC	Signals and Systems	3	0	0	3
4	20MA304BS	Probability Theory and Stochastic Processes	3	0	0	3
5	20MA305BS	Laplace Transforms, Numerical Methods and Complex Variables	3	1	0	4
6	20EC306PC	Digital System Design Lab	0	0	2	1
7	20EC307PC	Electronic Devices and Circuits Lab	0	0	3	1.5
8	20EC308PC	Basic Simulation Lab	0	0	3	1.5
9	20MC309GS	Gender Sensitization Lab	0	0	2	0
		Total Credits	**15**	**1**	**10**	**20**

IV SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	20EE401ES	Network Analysis	3	1	0	4
2	20EC402PC	Analog and Digital Communications	3	0	0	3
3	20EC403PC	Electronic Circuits and Pulse Circuits	3	0	0	3
4	20EC404PC	Electromagnetic Waves and Transmission lines	3	0	0	3
5	20EC405PC	Linear IC Applications	3	0	0	3
6	20EC406PC	Analog and Digital Communications Lab	0	0	2	1
7	20EC407PC	Electronic Circuits and Pulse Circuits Lab	0	0	3	1.5
8	20EC408PC	IC Applications lab	0	0	3	1.5
9	20MC409CI	Constitution of India	3	0	0	0
		Total Credits	**18**	**1**	**8**	**20**

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B. Tech. III Year Syllabus

ECE

V SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	20EC501PC	Microprocessors and Microcontrollers	3	0	0	3
2	20EC502PC	Data Communications and Networks	3	0	0	3
3	20EC503PC	Control Systems	3	1	0	4
4	20EC504PC	Antennas and Wave Propagation	3	0	0	3
5	20EC511PE 20EC512PE 20EC513PE	Professional Elective–I 1. Computer Organization & Operating Systems 2. Error Correcting Codes 3. Electronic Measurements and Instrumentation	3	0	0	3
6	20EC505PC	Microprocessors & Microcontrollers Lab	0	0	3	1.5
7	20EC506PC	Data Communications and Networks Lab	0	0	3	1.5
8	20EN507HS	Advanced Communication Skills Lab	0	0	2	1
9	20MC509IP	Intellectual Property Rights	3	0	0	0
		Total Credits	**18**	**1**	**8**	**20**

VI SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	20EC601PC	Microwave Engineering	3	0	0	3
2	20EC602PC	Digital Signal Processing	3	1	0	4
3	20EC603PC	VLSI Design	3	0	0	3
4	20EC621PE 20EC622PE 20EC623PE	Professional Elective–II 1. Object Oriented Programming through Java 2. Mobile Communications and Networks 3. Embedded System Design	3	0	0	3
5		Open Elective–I	3	0	0	3
6	20EC604PC	Digital Signal Processing Lab	0	0	2	1
7	20EC605PC	e–CAD Lab	0	0	3	1.5
8	20EC606PC	Microwave Engineering Lab	0	0	3	1.5
9	20MC608ES	*Environmental Science	3	0	0	0
		Total Credits	**18**	**1**	**8**	**20**

*19MC607ES -Environmental Science- Should be registered by the Lateral Entry Students Only.

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B. Tech. IV Year Syllabus (A.Y. 2023-24)

ECE

VII SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	20MB701HS	Business Economics &Financial Analysis	2	0	0	2
2	20EC731PE 20EC732PE 20EC733PE	Professional Elective–III 1. Artificial Neural Networks 2. Scripting Languages 3. Digital Image Processing	3	0	0	3
3	20EC741PE 20EC742PE 20EC743PE	Professional Elective–IV 1. Biomedical Instrumentation 2. Database Management Systems 3. Network Security and Cryptography	3	0	0	3
4	20EC751PE 20EC752PE 20EC753PE	Professional Elective–V 1. Satellite Communications 2. Radar Systems 3. Wireless Sensor Networks	3	0	0	3
5		Open Elective–II	3	0	0	3
6	20EC702PC	Scripting languages Lab	0	0	2	1
7	20EC703PC	Industrial Oriented Mini Project/Summer Internship	0	0	0	2*
8	20EC704PC	Technical seminar	0	0	2	1
9	20EC705PC	Project phase–I	0	0	4	2
		Total Credits	**14**	**0**	**8**	**20**

VIII SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	20BS801HS	Professional Practice, Law & Ethics	4	0	0	4
2	20EC861PE 20EC862PE 20EC863PE	Professional Elective–VI 1. System on Chip Architecture 2. Low Power VLSI Design 3. Global Positioning System	3	0	0	3
3		Open Elective–III	3	0	0	3
4	20EC802PC	Project final phase	0	0	20	10
		Total Credits	**10**	**0**	**20**	**20**

*Note: Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

Open Electives offered by ECE Department

Open Elective I (VI Semester)	Open Elective II (VII Semester)	Open Elective III (VIII Semester)
Principles of Electronic communications (20EC611OE)	**Electronic Sensors** (20EC721OE)	**Measuring Instruments** (20EC831OE)
Fundamentals of Internetof Things (20EC612OE)	**Microprocessors and Microcontrollers** (20EC722OE)	**Embedded Systems** (20EC832OE)

20MA101BS: Algebra and Calculus

	L	**T**	**P**	**C**
B.Tech. I Sem.	**3**	**1**	**0**	**4**

Course Objectives: To learn
1. Types of matrices and their properties, rank of the matrix, consistency and solving the system of linear equations.
2. Concept of Eigen values and eigenvectors and to reduce the Quadratic form to Canonical form.
3. Concept of Sequences and nature of the series.
4. Geometrical approach to the mean value theorems and their application to the mathematical problems and evaluation of improper integrals using Beta and Gamma functions.
5. Partial differentiation, concept of total derivative, finding maxima and minima of function of two and three variables.

Course Outcomes: After learning the contents of this paper the student must be able to
1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations.
2. 2Find the Eigen values and Eigen vectors and reduce the quadratic form to canonical form using orthogonal transformations.
3. Analyze the nature of convergence of sequence and series.
4. Solve problems involving mean value theorems and evaluate the improper integrals using Beta and Gamma functions.
5. Find the extreme values of functions of two variables with/ without constraints.

UNIT-I: Matrices   **10L**
Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew-Hermitian; Orthogonal matrices; Unitary Matrices; rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; solving system of Homogeneous and Non-Homogeneous equations. Gauss -elimination method; Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors   **10L**
Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors 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 by Orthogonal Transformation.

UNIT-III: Sequences & Series   **10L**
Sequence: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences.
Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert's ratio test; Raabe's test; Cauchy's Integral test; Cauchy's n^{th} root test.
Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence.

UNIT-IV: Calculus   **12L**

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem(without proof) with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem(without proof), Taylor's series of   single variable.Definition of improper integral: Beta and Gamma functions and their applications.

UNIT-V: Multivariable calculus (Partial Differentiation and applications)   **8L**
Definitions of Limit and continuity. Partial Differentiation; Euler's Theorem; Total derivative;
Jacobian; Functional dependence & independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

TEXTBOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

REFERENCES:
1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi publications, Reprint, 2008.
2. Higher Engineering Mathematics, (11th Reprint), Ramana B.V., Tata McGraw Hill New Delhi,2010.
3. Engineering Mathematics – I,T.K.V.Iyengar,B. Krishna Gandhi &Others, Edition S.Chand 2013.

20AP102BS: Applied Physics

	L	**T**	**P**	**C**
B.Tech. I Sem.	**3**	**1**	**0**	**4**

Course Objectives:
1. Quantum mechanics is one of the two foundational theories on which modern physics rests. The concept of wave function developed by Schrödinger and its formulation one-dimensional box are reinforced through relatively simple problems with analytic solutions.
2. The basics of semiconductors, energy bands formation, transport properties and generation recombination phenomena; Principle of operation of diodes and transistors including p-n junctions, Zener diode and BJTs provides background for subsequent courses in electronics.
3. Wave characteristics are those associated with interference and diffraction. An accurate technique for determining how and where waves propagate is given by Huygens's principle. Cosine law for thin film interference, Newtons ring's experiment and interferometer are discussed. The concept of Diffraction and resolving power of grating are explained.
4. LASER explains the basic mechanisms involved in the interaction between the laser medium and the light source. To expose on different types of laser, according to their amplifying medium and its applications. Optical fibre exposes students with the principle of optical fibre and basics of signal propagation through optical fibres and its applications.
5. Magnetic, dielectric behavior of various materials are exposed to students to apply in industry and engineering.

Course Outcomes:
The student would be able to learn the fundamental concepts on Quantum behaviour of matter in its micro state.
1. The knowledge of fundamentals of Semiconductor physics, will enable the students to apply to various systems like pn junction diodes, transistors, communication and so on.
2. The students can gain knowledge on the optical phenomena like Interference and diffraction.
3. LASER explains the basic mechanisms involved in the interaction between the laser medium and the light source. Students would be able to learn Optical fibre principle and its applications as new materials for various engineering applications.
4. The course also helps the students to be exposed to the magnetic materials and dielectric materials.

UNIT-I: Quantum Mechanics   10L

Introduction to quantum physics, Black body radiation, Planck's law, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

UNIT-II: Semiconductor Physics   10L

Introduction to semiconductors, calculation of intrinsic carrier concentration and extrinsic carrier concentration, Dependence of Fermi level on carrier concentration and temperature, Carrier transport: diffusion and drift currents, Hall effect, p-n junction diode, Zener diode and their V-I Characteristics, Bipolar Junction transistor(BJT): construction and operation.

UNIT-III: Wave Optics   10L

Introduction, Huygen's principle, Superposition of waves, Interference of light by wave front splitting and amplitude splitting, Young's double slit experiment, Interference in thin films by reflection-Cosine law, Newton's rings, Michelson's interferometer, Frunhofer diffraction due to single slit and double slit, Diffraction grating- resolving power.

UNIT-IV: Lasers and Fibre Optics   8L

Lasers: Introduction, Characteristics of Lasers, Einstein's coefficients, absorption, spontaneous emission, stimulated emission, population inversion, Pumping, lasing action, Types of Lasers: Ruby laser, He-Ne laser, semiconductor laser, Applications of laser.

Fibre Optics: Introduction, working principle of optical fibre, construction of optical fibre, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Losses associated with optical fibres, optical fibres in communication system.

UNIT-V: Dielectric and Magnetic Properties of Materials   12L

Dielectric Properties: Introduction to dielectrics, Polarisation, Permittivity and Dielectric constant, classification of polarizabilities, calculation of polarizabilities: electronic polarizability, ionic polarizability, Internal fields in a solid, Clausius-Mossotti equation, Ferroelectrics and Piezoelectrics, applications of dielectric materials.

Magnetic Properties: Magnetisation, permeability and susceptibility, Classification of magnetic materials, Ferromagnetism and ferromagnetic domains, Hysteresis, soft and hard magnetic materials, Applications of magnetic materials.

TEXT BOOKS

1. Applied Physics, B K Pandey, S. Chaturvedi, T Vijaya Krishna, T Madhu mohan, Cengage publisher

2. Engineering Physics, M K Harbola, Cengage publisher
REFERENCE BOOKS:

1. Engineering Physics, B.K.Pandey, S. Chaturvedi, Cengage Learning

2. Engineering Physics by Dr M N Avadhanulu, S-Chand publications

20EC103ES: Basic Electrical & Electronics Engineering

B.Tech. I Sem.

L	T	P	C
3	1	0	4

Course Objective:
1. To introduce the concepts of electrical circuits and its components.
2. To understand DC circuits and AC Circutes.
3. To study and understand the different types of electrical machines and variouselectrical installations.
4. To introduce the concepts of diodes & transistors.
5. To impart the knowledge of various configurations, characteristics andapplications.

Course Outcomes:
1. To analyze and solve the basic Electrical circuits using different network reduction techniques.
2. To understand the components of low Voltage Electrical Installations.
3. To study the working principles of Electrical Machines.
4. To identify and characterize diodes and their applications.
5. To identify and characterize of transistors and their applications.

UNIT – I   **10L**
D.C. CIRCUITS: Electrical circuit elements (R, L and C), voltage and current sources,KVL & KCL, analysis of simple circuits with dc excitation.
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 RL, RC, RLC series combination. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT – II   **10L**
TRANSFORMERS: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, O.C. and S.C. Tests, Three-phase transformer connections.
ELECTRICAL INSTALLATIONS: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing.

UNIT – III   **10L**
ELECTRICAL MACHINES: Construction and working principle of DC generators, types, emf equation, working principle of DC motors, Torque equation and Speed control of DC shunt motors, Construction and working principle of Three-phase Induction motor, Torque- slip Characteristics

UNIT – IV   **08L**
P-N JUNCTION AND ZENER DIODE: Principle of Operation Diode equation, Volt-Ampere characteristics, Static and dynamic resistances, Diode Capacitance-Diffusion and Transition capacitance, a Zener diode characteristics and applications.
RECTIFIERS: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Simple problems.

UNIT – V   **10L**
BIPOLAR JUNCTION TRANSISTOR (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations. SCR-Construction, Operation and V-I characteristic.

TEXTBOOKS:
1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education
3. Principles of Electrical Engineering and Electronics – V.K. Mehta, Rohit Mehta, S.Chand Publications
4. Electronic Devices and circuits – S. Salivahanan, N.Suresh Kumar, McGraw Hill

REFERENCE BOOKS:
1. Electronic Devices and Circuits – R. L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
5. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
6. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
7. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

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20ME104ES: Engineering Graphics

</div>

	L	**T**	**P**	**C**
B.Tech. I Sem.	**2**	**0**	**4**	**4**

Course objectives:

1. To provide basic concepts in engineering drawing.
2. To impart knowledge about standard principles of orthographic projection of objects.
3. To draw sectional views and pictorial views of solid.
4. To draw surfaces development of solid and prisms.
5. To draw isometric views of solids and basic concept of CAD software

Course Outcomes:

After successful completion of this course, the students should be able to

1. Understand the conventions and the methods of drawing engineering curves and scales.[Unit-I]
2. Understand and draw the projections of points, lines and planes in different types of projections.[Unit-II]
3. Understand and draw projections of solids and sectional views of solid (prisms),Auxiliary views.[Unit-III]
4. Understand and sketch the development of surfaces to Right Regular Solids-prism, intersection of Solids.[Unit-IV]
5. Prepare 2D & 3D drawings of solids and their transformations .isometric views of lines, plane figures and conversion of Isometric views to Ortho graphic views, Introduction of CAD software.[Unit-V]

Prerequisites: Knowledge of simple geometrical theorems and constructional procedure.

Course leaning outcomes:

After successful completion of the course, students will be able to,

1. Determine the location of the location and orientation of point, line, and plane with respect to reference planes to draw their projection.
2. Develop the project of various types of solids in various conditions.
3. Develop section views and true shape section of various types of solids.
4. Identify the need of development of lateral surfaces and the same in engineering drawing.
5. Develop orthographic views of an object to convert pictorial view into two-dimension (2D) view.
6. Develop isometric view to convert two dimension (2D) view to pictorial view.

UNIT- I
INTRODUCTION TO ENGINEERING DRAWING: **10L**
Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Involute. Scales – Plain, Diagonal and Vernier Scales. Introduction to CAD Software commands and practice.

UNIT - II
ORTHOGRAPHIC PROJECTIONS: **10L**
Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.—Auxiliary Planes.

UNIT –III   **10L**
Projections of Regular Solids – Auxiliary Views.

UNIT- IV
Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere. Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

UNIT –V   **10L**
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

Note: - The End Semester Examination will be conducted by using Auto Cad Software.

TEXTBOOKS:
1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

REFERENCE BOOKS:
1. Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
2. Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
3. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

20AP105BS: Applied Physics Lab

B.Tech. I Sem.

L	T	P	C
0	0	3	1.5

Course objectives

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. Apply the analytical techniques and graphical analysis to the experimental data.
4. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Course Outcomes

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

1. Apply the various procedures and techniques for the experiments.
2. Use the different measuring devices and meters to record the data with precision.
3. Apply the mathematical concepts/equations to obtain quantitative results.
4. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

List of Experiments:

1. Torsional pendulum:

   To determine the rigidity modulus of the material of the given wire using torsional pendulum.

2. Newton's rings:

   To determine the radius of curvature of the lens by forming Newton's rings.

3. Dispersive power:

   To determine the dispersive power of prism by using spectrometer.

4. LCR Circuit:

   To determine quality factor and the resonant frequency of LCR circuit.

5. a. To study the V-I characteristics of LASER sources.

   b. Plot V-I characteristics of light emitting diode.

6. Optical fibre:

   a. To determine the bending losses of Optical fibres

   b. To determine the Numerical aperture of a given fibre.

7. R-C Circuit:

   To determine the time constant of R-C circuit.

8. Solar Cell:

   To study the V-I Characteristics of solar cell.

9. Stewart – Gee's experiment:

   Determination of magnetic field along the axis of a current carrying coil.

10. Energy gap of P-N junction diode:

    To determine the energy gap of a semiconductor diode.

Note: Minimum 8 experiments are to be performed

20EC106ES: Basic Electrical & Electronics Engineering Lab

	L	**T**	**P**	**C**
B.Tech. I Sem.	**0**	**0**	**3**	**1.5**

COURSE OBJECTIVES:
1. To analyze a given network by applying network reduction techniques.
2. To expose the students to the operation of DC motors and transformers.
3. To expose the students to the operation of three phase induction motors and alternators.
4. To study basic electronic components.
5. Analyze the characteristics of different electronic devices such as diodes and transistors.

COURSE OUTCOMES
After successfully studying this course, students will:
1. Able to solve the different networks using the concept of circuit laws.
2. Able to characterize the performance of DC Motors and single phase transformer.
3. Able to characterize the performance of three phase induction motors and alternators.
4. Able to understand the characteristics of different electronic devices such as diodes and transistors.
5. Able to understand the half wave and full wave rectifiers with and without filters.

SECTION A: ELECTRICAL ENGINEERING:
1. Verification of KCL and KVL.
2. Verification of Ohms Law.
3. Three-phase transformer: Verification of Relationship between voltages and currents.(Star –Star, Star – Delta, Delta – star, Delta - Delta)
4. Load Test on Single-phase transformer.
5. Brake test on DC shunt motor.
6. OC and SC tests on Single-phase transformer.
7. Brake test on 3-phase Induction motor.
8. No Load Characteristics of 3 phase Alternator.

SECTION B: ELECTRONICS ENGINEERING:
1. Study and operation of
   (i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies
2. PN Junction Diode Characteristics (Forward bias, Reverse bias)
3. Zener Diode Characteristics
4. Study of CRO.
5. Transistor CE Characteristics
6. Rectifier without Filters (Full wave & Half wave)
7. Rectifier with Filters (Full wave & half wave).

Note: Total 10 experiments are to be conducted.
(Five experiments from PART-A, Five experiments from PART-B)

20EC107ES: Basic Elements of Engineering Technology

	L	T	P	C
B.Tech. I Sem.	0	0	2	1

Objectives:
1. Exploring different engineering technologies and their applications.
2. Student should be able to understand IT Networking, Protocols and Computations.
3. Understanding the principle of IoT and its architecture.
4. Knowledge towards Assembling and testing of robots.
5. Understanding functionality of 3D printers and their application.
6. Developing team work and insight towards different disciplines of Engineering.

Module I: Network & Computing
PC Hardware: Identify the peripherals of a computer, components in a CPU and its functions. Block diagram of the CPU along with the configuration of each peripheral, disassemble and assemble the PC back to working condition. Install MS Windows / Linux on the personal Computer / Laptop and dual boot configuration.
Connectivity Boot Camp: Connecting to their Local Area Network and access the Internet. Configuration of the TCP/IP setting, access the websites and email.
Web Browsers, Surfing the Web: Customize web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Module II: Internet of Things
Overview of IoT and Architecture: Brief History, evolution of IoT, Architecture, trends in the Adoption of IoT, Societal Benefits of IoT, Risks, Privacy, Security, Embedded Systems Components, Micro-controller Architecture and Properties and Installing and Setting up the Arduino and Raspberry Pi (RPi) development environment. Build Simple IoT Applications by using Arduino or RPi.

Module III: Robotics
Introduction, Different types of robots, Components of a Robot, Working principle of robots, Applications of robots in various fields, Innovation challenges, Scope of robotics research & its current trends, assembling and testing of Robot.

Module IV: 3D Printing
Introduction, Product Design & Development, 3D Scanning & Printing using different types of materials. Components of 3D Printer, Applications of 3D printed products in various fields, Hands on Experience on 3D printing Machines.

Module V: Case Studies
Students has to submit a report by doing a study on various Engineering applications related to Manufacturing, Retail, Automotive, Logistics, Healthcare, Entertainment and E-Governance.

REFERENCE BOOKS:

1. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
2. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
3. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
4. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
5. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
6. Deb S R.and DebS., ―Robotics Technology and Flexible Automation‖, Tata McGraw Hill Education Pvt. Ltd, 2010.
7. Mikell P Groover, ―Automation, Production Systems, and computer integrated Manufacturing‖, Prentice Hall, 2001.
8. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping.
9. Andreas Gebhardt, Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing

20MC108ES: Environmental Science

B.Tech. I Sem.

L	T	P	C
3	0	0	0

Course objectives:
The students should be able to understand
1. Ecosystem responses to environmental change it will be used to communicate central Eco-system characteristics to a wider community. The main objectives of natural resources is to better understand the roll of resources in economy older to develop more sustainable methods of mapping those resources to ensure their ability to future generation.
2. The main objectives of natural resources is to better understand the roll of resources in economy older to develop more sustainable methods of mapping those resources to ensure their ability to future generation.
3. Bio-diversity is the degree of variation of life resources forms within a given species. it describes organisms in the natural environment, which provided the eco-system service that form our natural capital.
4. Control of pollution at source the maximum extent possible with due regard to technology achievement and economic viability as well as sensitive of the receiving environment.
5. Ensure it environmental factors are consider in the decision making process and adverse environmental impacts or identified, avoided and minimized. Enforce environmental registration for which the council is responsible.

Course outcomes:
The students should be able to
1. A student will be able to understand the basics of biotic and abiotic things present in the environment and their effects on environment.
2. A student will be able to understand the basics of natural resources and impacts of things present in the environment and their effects.
3. A student will be able to understand the varieties of life forms and conservation techniques.
4. A student will be able to understand the effects of technological, scientific development on environment.
5. A student will be able to assess the impacts on environment and strategic management of environment as stipulated by the local legislative rules, regulations and concepts of sustainable growth related to human life.

UNIT-I: **10L**
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, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II: **5L**
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: 7L
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: 13L
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: 7L
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. Overview 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 University Grants 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, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS.Publications.

20MA201BS: Ordinary Differential Equations and Vector Calculus

B.Tech. II Sem.

L	T	P	C
3	1	0	4

Course Objectives: To learn
1. Methods of solving the differential equations of first and higher order.
2. Applications of first order ordinary differential equations (Orthogonal trajectories, Newton's law of cooling, Natural growth and Decay)
3. Evaluation of surface areas and volumes of revolution of curves.
4. The physical quantities involved in engineering field related to the vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and Volume integrals.

Course Outcomes: After learning the contents of this paper the student must be able to
1. Identify whether the given differential equation of first order is exact or not.
2. Solve higher order differential equation and apply the concept of differential equation to real World problems.
3. Evaluate the multiple integrals and apply the concept to find area and volumes of revolution of curves.
4. Evaluate Gradient, Divergence and Curl of vector differential operator.
5. Evaluate the line, surface and volume integrals and converting them from one to another.

UNIT-I: First Order Differential Equations and Applications   12L
Formation of Differential Equation, Differential Equations of first order and first degree: Variable Separable, Homogeneous Differential Equations, Exact Differential Equation-Reducible to exact, Linear and Bernoulli's equations.
Applications: Orthogonal trajectories, Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Higher Order Differential Equations   10L
Linear Differential Equations of Second and Higher Order with constant coefficients: Non-Homogeneous terms of the type f(x) $=e^{ax}$, sinax, cosax, polynomial in x, $e^{ax}(x)$ and x(x); Method of variation of parameters; Cauchy Homogeneous Linear equation .

UNIT-III: Multivariable Calculus (Integration)   10L
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. Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates).

UNIT-IV: Vector Differentiation   8L
Vector Differentiation**:** Scalar and vector point functions, Gradient, Divergence, and Curl. Directional derivatives, tangent plane and normal line, vector identities scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration   10L
Vector Integration: Line Integral, Work done by force, surface and volume integrals.
Vector integral theorems: Green's, Stoke's and Gauss divergence theorems (without proof) and their applications.

TEXT BOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42 nd Edition, 2012
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, 4th Ed., Narosa Publishing House, New Delhi,2014.
3. T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganathan and M.V.S.S.N.Prasad, Engineering Mathematics.

REFERENCES:
1. E. Kreyszig, Advanced Engineering Mathematics, 9th Ed Wiley,2012.
2. B.V. Ramana , Engineering Mathematics, 4th Ed., Tata McGraw Hill, New Delhi,2009.
3. A textbook of Engineering Mathematics, Ninth Edition by N. P. Bali, Dr Manish Goyal.

20CH202BS: Engineering Chemistry

	L	**T**	**P**	**C**
B.Tech. II Sem.	**3**	**1**	**0**	**4**

Course Objectives:
1. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
2. To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
3. To acquire the knowledge of electro chemistry, corrosion and water treatment which are essential for the engineers and in industry.
4. To acquire the knowledge about electronic, infra-red and NMR spectra.
5. To impart the knowledge of stereo chemistry and synthetic aspects useful for understanding reaction pathways.

Course Outcomes:
The basic concepts included in this course will help the student to gain:
1. The knowledge of atomic, molecular and complex compound structures.
2. The required skills to get clear concepts on hard water, hardness and different purification methods of water.
3. The required principles and concepts of electro chemistry, corrosion and in understanding the problem of water and its treatments.
4. The knowledge of configurational and conformational analysis of molecules and reaction mechanisms.
5. The knowledge of electronic, infrared and NMR spectra.

UNIT-I: 10L
Molecular structure and Theories of Bonding: Atomic and Molecular orbitals
Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N_2, O_2, O_2^-, CO, NO and F_2 molecules. π-molecular orbitals of butadiene and benzene.
Crystal Field Theory (CFT): Salient Features of CFT–Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries.

UNIT-II: 8L
Water Chemistry: (08 Hours)
Introduction-hardness of water-Causes of hardness-Types of hardness: temporary and permanent-expression and units of hardness-Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water–Disinfection of water by chlorination and ozonization. Boiler feed water and its treatment-Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water-Ion exchange process. Desalination of water-Reverse osmosis. Numerical problems.

UNIT –III: 12L
Electrochemistry and corrosion:
Electrochemistry: Electrochemical cells-electrode potential, standard electrode potential, types of electrodes-calomel, Quinhydrone and glass electrode. Nernst equation- Determination of pH of a solution by using glass electrode. Electrochemical series and its applications. Numerical problems.
Batteries: Primary (Lithium cell) and secondary batteries (Lead-acid storage battery and Lithium ion battery).
Corrosion: Causes and effects of corrosion-theories of corrosion: 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 anodic and impressed current cathodic protection. Surface coatings-metallic coating methods: Hot dipping, Electroplating and Electroless plating of Nickel.

UNIT – IV: **10L**
Stereochemistry, Reaction Mechanism and synthesis of drug molecules.
Stereochemistry: Isomerism: structural and stereo isomers, configurations, symmetry and chirality. Enantiomers, diastereomers, optical activity and absolute configuration. Conformational analysis of n-butane.
Reaction Mechanism: Substitution reactions: Nucleophilic substitution reactions: Mechanism of SN^1, SN^2 reactions. Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions. Grignard addition of carbonyl compounds. Elimination reactions: Dehydrohalogenation of alkylhalides-Saytzeff's rule. Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and chromic acid. Reduction reactions: reduction of carbonyl compounds using $LiAlH_4$ & $NaBH_4$.
Drug molecules: Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

UNIT-V: **10L**
Spectroscopic techniques and applications.
Introduction to spectroscopy, electromagnetic spectrum**:** Principles of electronic magnatic spectroscopy spectroscopy-Lambert –Beer's Law, selection rules: Woodward–Fieser rule. Chromophore, auxochrome and various shifts. Applications of electronic spectroscopy. Principle and selection rules of vibrational and rotational spectroscopy. Applications of vibrational and rotational spectroscopy. Basic concepts of Nuclear magnetic resonance Spectroscopy, chemical shift and splitting pattern of NMR signals. Applications of NMR: Introduction to Magnetic resonance imaging.

TEXT BOOKS:
1. Engineering Chemistry by P. C Jain and M. Jain, Dhanpat Rai Publications, New Delhi, 16th Edition.
2. Text book of Engineering chemistry by Jaya shree Anireddy, Wiley Publications.
3. Engineering Chemistry by Prasanta Rath, B. Rama Devi, Ch. Venkata Ramana Reddy, Subhendu Chakroborty, Cengage Publications, New Delhi-2018.
4. A Textbook of Engineering Chemistry by Dr. Bharathi Kumari Yalamanchili, VGS Techno Series (R18 Syllabus)
5. A Textbook of Engineering Chemistry by Shashi Chawla, Dhanpat Rai Publications, New Delhi.

REFERENCES:
1. Engineering Chemistry by S. S. Dara, S. Chand & Company Ltd, New Delhi.
2. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, New Delhi.
3. Engineering Chemistry by B. Sivasankar, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

20CS203ES: Programming For Problem Solving

B.Tech. II Sem.

L	T	P	C
3	1	0	4

Course Objectives:

1. To learn the fundamentals of computers, algorithms and flowcharts.
2. To learn how arrays, pointer, structure and union are used.
3. To learn preprocess command and implement file in c
4. To learn the concepts code reusability using Functions.
5. To learn various searching and sorting techniques using Arrays

Course Outcomes: The student will learn

1. To write algorithms and to draw flowcharts for solving problems.
2. To understand use arrays, pointers, strings and structures to write C programs.
3. To understand the files using C programs.
4. To decompose a problem into functions and to develop modular reusable code.
5. To understand the Searching and sorting problems.

UNIT - 1: Introduction to Programming   **12L**

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program etc., Number systems Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming

Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators.

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

UNIT - II: Arrays, Strings, Structures and Pointers   **10L**

Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays
Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings
Structures: Defining structures, initializing structures, unions, Array of structures
Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self referential structures in linked list (no implementation), Enumeration data type.

UNIT - III: Pre processor and File handling in C   **9L**

Pre processor: Commonly used Pre processor commands like include, define, undef, if, ifdef, ifndef
Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

UNIT - IV: Function and Dynamic Memory Allocation   9L
Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries
Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions
Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

UNIT - V: Introduction to Algorithms: 10L
Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number, etc.
Basic searching in an array of elements (linear and binary search techniques),
Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms),
Basic concept of order of complexity through the example programs

TEXT BOOKS:
1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rdEdition)

REFERENCE BOOKS:
1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4thEdition

20EN204HS-Engilish

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

Course Objectives:

The course will help students to-

1. Apply their knowledge of English grammar and vocabulary in a variety of written compositions.
2. Examine a given text accurately to achieve optimum comprehension.
3. Develop study skills and techniques.
4. Analyze the content of other academic subjects critically.
5. Express cognitive and affective ideas and experiences clearly.

Course Outcomes:

Students should be able to-

1. Generate ideas and create effective sentence structures in spoken and written forms.
2. Comprehend passages and texts critically and respond appropriately.
3. Select specific approaches to study and retain information.
4. Interpret technical content using theoretical and practical components of English language.
5. Communicate effectively in formal and informal contexts.

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students

In English classes, the focus should be on the enhancement of skills in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. The focus in this syllabus is on skill development and also on personality development fostering ideas and practice of language skills and exhibiting the right values and ethics in various contexts and cultures.

Learning Objectives: The course will help to

- Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
- Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus.
- Develop Study Skills and Communication Skills in formal and informal situations.
- Integrate Value Education and Ethics.

Course Outcomes: Students should be able to

- Use English Language effectively in spoken and written forms.
- Comprehend the given texts and respond appropriately.
- Communicate confidently and assertively in various contexts and different cultures.
- Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

UNIT –I: **8L**

'Mokshagundam Visvesvaraya' from the prescribed text book by JNTUH

'Epitome of Wisdom' - Maruthi Publications.

Vocabulary Building: The Concept of Word Formation -The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
Reading: Reading and Its Importance- Techniques for Effective Reading.
Basic Writing Skills: 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: 8L
'Ancient Architecture in India' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Synonyms and Antonyms.
Grammar: Identifying Common Errors in Writing with Reference to Noun - PronounAgreement and Subject-verb Agreement.
Reading: Improving Comprehension Skills – Techniques for Good Comprehension.
Writing: Format of a Formal Letter - **Writing Formal Letters-** Letter of Complaint, Letter of Requisition, Job Application with Resume.

UNIT –III: 9L
'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary- Homonyms, Homophones, One-word substitutes.
Grammar- Misplaced Modifiers and Tenses.
Reading-Reading poem 'Stopping by Woods on a Snowy Evening' by Robert Frost.
Writing- Note-making, Information Transfer.

UNIT –IV: 8L
'What Should You Be Eating' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Standard Abbreviations and Acronyms in English.
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension- Intensive Reading and Extensive Reading.
Writing: Essay Writing-Précis Writing.

UNIT –V: 10L
'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Technical Vocabulary
Grammar: Common Errors in English
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report - Categories of Report - Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

PRESCRIBED TEXTBOOK:
Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge UniversityPress.
REFERENCES:
1. Epitome of Wisdom – Maruthi Publications
2. English Grammar by David Green
3. Swan, M.(2016). Practical English Usage. Oxford University Press.
4. Kumar, S and Lata, P.(2018). Communication Skills. Oxford UniversityPress.
5. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
6. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
7. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.
8. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

20ME205ES: Engineering Workshop

	L	T	P	C
B.Tech. II Sem.	0	0	3	1.5

Course Objective:
Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems.

Course Outcomes: On completion of the course, students will be able to
1. Create the different patterns with desired shape and size by using wood.
2. Align and assemble different components to create a product by fitting operations.
3. Fabricate the given material to desired product in a particular pattern by tin smithy.
4. Explain the basic principles of electrical systems in day-to-day applications.
5. Mould the component to desire pattern and shape by black smithy.
6. Create the object by casting process using molten metal.
7. Assemble the components with permanent joint by welding process.
8. Describe the process, transfer of fluid or gases from one place to another place by connecting set of pipes with different requirements in plumbing process

I.   (Two experiments each from any six trades of the following)
1. Carpentry
2. Fitting
3. Tin-smithy
4. House-wiring
5. Foundry
6. Plumbing
7. Welding
8. Black smithy

II.   Trades for Demonstration and Exposure:
1. Power tools
2. Machine Tools- Operations on Lathe.

Course Outcomes: On completion of the course, students will be able to
1. Create the different patterns with desired shape and size by using wood.
2. Align and assemble different components to create a product by fitting operations.
3. Fabricate the given material to desired product in a particular pattern by tin smithy.
4. Explain the basic principles of electrical systems in day-to-day applications.
5. Mould the component to desire pattern and shape by black smithy.
6. Create the object by casting process using molten metal.
7. Assemble the components with permanent joint by welding process.
8. Describe the process, transfer of fluid or gases from one place to another place by connecting set of pipes with different requirements in plumbing process

TEXT BOOK:
1. P Kannaiah and K L Narayana, Workshop Manual, Scitech publishers, Second Edition.

20CH206BS: Engineering Chemistry Lab

B.Tech. II Sem.

L	T	P	C
0	0	3	1.5

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:
1. Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
2. To determine the rate constant of reactions from concentrations as a function of time.
3. The measurement of physical properties like surface tension and viscosity.
4. To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.
5. To estimate amount of compound by instrumental titration methods like conductometry, potentiometry and colorimetry.

Course Outcomes: The experiments will make the student gain skills on:
1. Determination of parameters like hardness and chloride content in water.
2. Estimation of rate constant of a reaction from concentration 鈥 time relationships.
3. Determination of physical properties like surface tension and viscosity.
4. Calculation of Rf values of some organic molecules by TLC technique.
5. Estimation of amount by conductometry, potentiometry and colorimetry.

List of Experiments:
1. Determination of total hardness of water by complexometric method using EDTA.
2. Determination of chloride content of water by Argentometry.
3. Estimation of HCl by Conductometric titrations.
4. Estimation of Acetic acid by Conductometric titrations.
5. Estimation of HCl by Potentiometric titrations.
6. Estimation of Fe2+ by Potentiometry using KMnO4.
7. Determination of rate constant of acid catalysed hydrolysis of methyl acetate.
8. Synthesis of Aspirin.
9. Thin layer chromatography calculation of Rf values. Ex; ortho and para-nitro phenols.
10. Determination of acid value of coconut oil.
11. Estimation of ferrous iron in cement by colorimetric method.
12. Determination of viscosity of given solvent by using Ostwald's viscometer.
13. Determination of partition coefficient of acetic acid between n-butanol and water.
14. Determination of surface tension of a give liquid using stalagmometer.

Note: Any 12 experiments are to be performed References
1. Senior practical physical chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co., Delhi).
2. An introduction to practical chemistry, K.K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi).
3. Vogel's text book of practical organic chemistry 5th edition.
4. Text book on experiments and calculations in engineering chemistry–S.S. Dara.

20EN207HS: English Language and Communication Skills Lab

	L	**T**	**P**	**C**
B.Tech. II Sem.	**0**	**0**	**3**	**1.5**

Course Objectives:
The course will help students to-
1. Use computer-assisted multi-media instruction enabling individualized and independent language learning.
2. Articulate the nuances of English speech sounds distinctly.
3. Modify their accent aiming for intelligibility of speech.
4. Avoid mother tongue interference in their speech.
5. Present a topic individually and in a group in various formal situations.

Course Outcomes:
Students will be able to-
1. Imitate native accent through audio- visual experience and practice.
2. Pronounce English sounds according to standard pronunciation (RP of England).
3. Speak fluently and clearly.
4. Neutralize their accent thus refining their speech.
5. Participate in discussions and presentations effectively and confidently.

Learning Outcomes: Students will be able to attain
1. Better understanding of nuances of English language through audio- visual experience and group activities.
2. Neutralization of accent for intelligibility.
3. Speaking skills with clarity and confidence which in turn enhances their employability skills.

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab
2. Interactive Communication Skills (ICS) Lab

Listening Skills
Objectives:
1. To enable students develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

   • Listening for general content
   • Listening to fill up information
   • Intensive listening
   • Listening for specific information

Speaking Skills
Objectives:
1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
   - Oral practice: Just A Minute (JAM) Sessions
   - Role play – Individual/Group activities
   - Group discussions and Mock interviews

Exercise – I
CALL Lab:
Understand: Listening Skill-Its Importance- Purpose-Process-Types-Barriers of Listening.
*Practice***:** Introduction to Phonetics – Speech Sounds – Vowels and Consonants.
ICS Lab:
Understand: Communication at Work Place- Spoken vs. Written language.
Practice: Ice-Breaking Activity and JAM Session- Greetings - Introducing Oneself and Others - Taking Leave.

Exercise – II
CALL Lab:
Understand: Minimal Pairs- Consonant Clusters- Past Tense Markers and Plural Markers.
Practice: Differences in British and American Pronunciation.
ICS Lab:
Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Situational Dialogues – Role-Play (face-to-face & telephonic) - Expressions in Various Situations.

Exercise – III
CALL Lab:
Understand: Structure of Syllables – Word Stress - Weak Forms and Strong Forms in Context – Rhythm
Practice: Basic Rules of Word Accent – Stress Shift.
ICS Lab:
Understand: Exposure to structured talks - How to make Formal Presentations.
Practice: Power Point Presentations.

Exercise – IV
CALL Lab:
Understand: Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI).
Practice: Rising Tones and Falling Tones- Neutralization of accent.
ICS Lab:
Understand: Importance of Team work as a team leader and a team player
 Practice: Group Discussion

Exercise - V
CALL Lab:
Understand: Listening for general & specific details.
Practice: Listening Comprehension Tests.
ICS Lab:
Understand*:* Interview Skills.
Practice: Mock Interviews

1. **Minimum Requirement of infrastructural facilities for ELCS Lab:**

- **Computer Assisted Language Learning (CALL) Lab:** The Computer Assisted Language Learning Lab has to accommodate 30 students with 30 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

    System Requirement (Hardware component):

- Computer network with LAN facility (minimum 30 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 audio-visual aids with a Public-Address System, an LCD and a Projector.

20CS208ES: Programming For Problem Solving Lab

B.Tech. II Sem.

L	T	P	C
0	0	3	1.5

[Note:The programs may be executed using any available Open Source/ Freely available IDE Some of the Tools available are:
CodeLite: https://codelite.org/
Code::Blocks: http://www.codeblocks.org/
DevCpp : http://www.bloodshed.net/devcpp.html
Eclipse: http://www.eclipse.org This list is not exhaustive and is NOT in any order of preference]

Course Objectives: The students will learn the following:
1. To work with an IDE to create, edit, compile, run and debug programs
2. To analyze the various steps in program development.
3. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
4. To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
5. To Write programs using the Dynamic Memory Allocation concept.
6. To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:
1. formulate the algorithms for simple problems
2. translate given algorithms to a working and correct program
3. correct syntax errors as reported by the compilers
4. identify and correct logical errors encountered during execution
5. represent and manipulate data with arrays, strings and structures
6. use pointers of different types
7. create, read and write to and from simple text and binary files
8. modularize the code with functions so that they can be reused

Practice sessions:
a. Write a simple program that prints the results of all the operators available in C (including pre/ post increment, bitwise and/or/not , etc.). Read required operand values from standard input.
b. Write a simple program that converts one given data type to another using auto conversion and casting. Take the values form standard input.

Simple numeric problems:
a. Write a program for fiend the max and min from the three numbers.
b. Write the program for the simple, compound interest.
c. Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.
d. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
e. 5 x 1 = 5
f. 5 x 2 = 10
g. 5 x 3 = 15

h. Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

a. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).

b. 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)

c. Write a program that finds if a given number is a prime number

d. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.

e. A 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. Write a C program to generate the first n terms of the sequence.

f. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

g. Write a C program to find the roots of a Quadratic equation.

h. Write a C program to calculate the following, where x is a fractional

value.i. 1-x/2 +x^2/4-x^3/6

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

Arrays and Pointers and Functions:

a. Write a C program to find the minimum, maximum and average in an array of integers.

b. Write a functions to compute mean, variance, Standard Deviation, sorting of n elements in single dimension array.

c. Write a C program that uses functions to perform the following:

d. Addition of Two Matrices

e. ii. Multiplication of Two Matrices

f. iii. Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be same.

g. Write C programs that use both recursive and non-recursive functions

h. To find the factorial of a given integer.

i. ii. To find the GCD (greatest common divisor) of two given integers.

j. iii. To find x^n

k. Write a program for reading elements using pointer into array and display the values using array.

l. Write a program for display values reverse order from array using pointer.

m. Write a program through pointer variable to sum of n elements from array.

Files:

a. Write a C program to display the contents of a file to standard output device.

b. b. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.

c. Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.

d. Write a C program that does the following:
It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function) Now the

program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function) The program should then read all 10 values and print them back.

  e. 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).

Strings:
  a. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
  b. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
  c. Write a C program that uses functions to perform the following operations:
  d. To insert a sub-string in to a given main string from a given position.
  e. ii. To delete n Characters from a given position in a given string.
  f. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
  g. Write a C program that displays the position of a character ch in the string S or – 1 if S doesn't contain ch.
  h. Write a C program to count the lines, words and characters in a given text.

Miscellaneous:
  a. Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

  b. Write a C program to construct a pyramid of numbers as follows:

```
1              *          1          1          *
1 2            * *        2 3        2 2        * *
1 2 3          * * *      4 5 6      3 3 3      * * *
                                    4 4 4 4    * *
                                               *
```

Sorting and Searching:
  a. Write a C program that uses non recursive function to search for a Key value in a given List of integers using linear search method.
  b. Write a C program that uses non recursive function to search for a Key value in a given Sorted list of integers using binary search method.
  c. Write a C program that implements the Bubble sort method to sort a given list of Integers in ascending order.
  d. Write a C program that sorts the given array of integers using selection sort in descending order
  e. Write a C program that sorts the given array of integers using insertion sort in ascending order
  f. Write a C program that sorts a given array of names

Suggested Reference Books for solving the problems:
  i.   Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
  ii. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
  iii. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
  iv. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
  v.   Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
  vi. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition.

20EC301PC: Electronic Devices and Circuits

B.Tech. III Sem.

L	T	P	C
3	0	0	3

Pre-requisite: Basic Electrical and Electronics Engineering

Course Objectives:
1. To introduce biasing, compensation techniques and Small Signal low frequency BJT Amplifiers.
2. To analyze the multistage amplifiers of BJT and high frequency analysis of BJT.
3. To know about Special purpose devices and the types of JFET, characteristics and it's applications also.
4. To understand various FET amplifier circuits.
5. To understand working principle of various types of feedback amplifier circuits.

Course Outcomes: Upon completion of the Course, the students will be able to:
1. Understand the concepts of biasing, compensation techniques and Design and analyze Small Signal low frequency Amplifiers.
2. Analyze the multistage amplifiers of BJT and high frequency analysis.
3. Understand Special purpose devices and JFET, characteristics and its applications.
4. Analyze the various configuration of JFET amplifier and concept of MOSFETs.
5. Compare and Contrast various types of Feedback amplifiers and Oscillator circuits.

UNIT – I   **12L**
Transistor Biasing and Stabilization: Need for biasing, DC and AC load lines, operating point, fixed bias, collector to base bias, self bias techniques for stabilization, stabilization factors (S, S',S''), Thermal runaway and thermal stability. Bias compensation using diodes, Thermistor and Sensistor compensation.
Analysis of Small Signal low frequency Amplifiers: Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE, CB and CC configurations, Transistor as an amplifier, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of CE Amplifier- effect of coupling and bypass capacitors.

UNIT – II   **10L**
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 PI- model of Common Emitter transistor model, $f\alpha$, f_β and unity gain bandwidth, Gain-bandwidth product.

UNIT – III   **08L**
Special purpose devices: Principle of operation of SCR, Tunnel Diode, Photo diode, LED and Varactor diode.
Junction Field Effect Transistor (JFET): Construction, Principle of operation, Pinch-off Voltage, Volt- Ampere Characteristics, Comparison of BJT and FET, Biasing of FET, FET as Voltage Variable Resistor.

UNIT IV   **08L**
FET Amplifiers: Small Signal Model**,** Analysis of JFET Amplifiers, Analysis of CS, CD, CG JFET Amplifiers. MOSFET Characteristics in Enhancement and Depletion mode, Basic Concepts of MOS Amplifiers.

UNIT V   **08L**
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.
Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

TEXT BOOKS:
1. Electronic Devices and Circuits- Jacob Millman, McGraw HillEducation.
2. Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009,Pearson.

REFERENCE BOOKS:
1. The Art of Electronics, Horowitz, 3rdEdition Cambridge University Press.
2. Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford.

20EC302PC: Digital System Design

B.Tech. III Sem.

	L	T	P	C
	3	0	0	3

Pre-Requisites: Nil

Course Objectives:
1. To understand common forms of number representation in logic circuits.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
3. To understand the concepts of combinational logic circuits and sequential circuits.
4. To understand the Realization of Logic Gates using Diodes &Transistors.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand the numerical information in different forms and Boolean Algebra theorems.
2. Apply the simplification methods such as Boolean algebra, kmap and Tabular method to simplify the given Boolean function.
3. Design and analyze various combinational and sequential circuits.
4. Understand Concepts of Sequential Machines & Analyze the finite state machines such as Mealy and Moore machine
5. Understand the logic families and realization of logic gates Using Diodes & Transistors.

UNIT - I: **10L**
Number Systems: Number systems, Complements of Numbers, Codes- Weighted and Non-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: **10L**
Minimization of Boolean functions: Karnaugh map method - up to five 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   **12L**
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 toanother.
Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

UNIT – IV   **10L**
Sequential Machines: Finite State Machines, Synthesis of Synchronous Sequential Circuits-Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N – Counters. Finite state machine-capabilities and limitations, Mealy and Moore models.

UNIT – V   **08L**

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, Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate- Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tri- state outputs, CMOS transmission gate, IC interfacing- TTL driving CMOS & CMOS driving TTL.

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- TataMcGraw-Hill

REFERENCE BOOKS:

1. Digital Design- Morris Mano, PHI, 4thEdition,2006
2. Introduction to Switching Theory and Logic Design – FredriacJ. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & SonsInc.
3. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition,2004.
4. Switching Theoryand Logic Design – A Anand Kumar, PHI,2013

20EC303PC: Signals and Systems

B.Tech. III Sem.   **L   T   P   C**
                                                                3   0   0   3

Course Objectives:
1. This gives the basics of Signals and Systems required for all Electrical Engineering related courses.
2. To understand the behavior of signal in time and frequency domain.
3. To understand the characteristics of LTI systems.
4. This gives concepts of Signals and Systems and its analysis using different transform techniques.

Course Outcomes: Upon completing this course, the student will be able to
1. Differentiate various signal functions.
2. Express periodic signals in terms of Fourier series and Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
3. Understand the characteristics of linear time invariant systems.
4. Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems
5. Understand sampling, reconstruction and correlation of the signals.

UNIT – I   **08L**
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   **10L**
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   **10L**
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-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   **10L**
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   **08L**
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, Parseval's 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.

TEXT BOOKS:
1. Signals, Systems & Communications - B.P. Lathi, 2013,BSP.
2. Signals and Systems - A.V. Oppenheim, A.S. Willskyand S.H. Nawabi, 2^{nd}Ed.

REFERENCE BOOKS:
1. Signals and Systems – Simon Haykin and Van Veen, Wiley 2nd Ed.
2. Signals and Systems – A. Rama Krishna Rao, 2008,TMH.
3. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.
4. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, 3rd Ed., 2004,PE.
5. Signals and Systems – K. Deergha Rao, Birkhauser,2018.

20MA304ES: Probability Theory and Stochastic Processes

B.Tech. III Sem.   **L   T   P   C**
                                                                 3   0   0   3

Pre-requisite: Nil

Course Objectives:
1. This gives basic understanding of random signals and processing
2. Utilization of Random signals and systems in Communications and Signal Processing areas.
3. To know the Spectral and temporal characteristics of Random Process.
4. To Learn the Basic concepts of Noise sources.

Course Outcomes: Upon completing this course, the student will be able to
1. Describe the axiomatic formulation of modern Probability Theory and random variables.
2. Understand the concepts of Random Process and its Characteristics.
3. Analyze the response of linear time Invariant system for a Random Processes.
4. Determine the Spectral and temporal characteristics of Random Signals.
5. Understand the concepts of Noise in Communication systems.

UNIT – I   **08L**
Introduction to Probability & the Concept of Random Variable: Probability introduced through sets and Relative Frequency, Random Experiments and Sample spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Baye's Theorem, Independent Events. Random Variable - Definition, Conditions for a function to be a random variable, Discrete, Continuous, and Mixed Random Variables, Distribution Function - Properties, Density Function - Properties. Methods of defining Conditioning Event, Conditional Distribution, Conditional Density, and their Properties. Vector Random Variables: Joint Distribution Function - Properties, Joint Density Function - Properties, Marginal Distribution and Density Functions, Conditional Distribution and Density: Point Conditioning, Interval conditioning, Statistical Independence.

UNIT – II   **12L**
Operations On Single & Multiple Random Variables – Expectations: Expected Value of a Random Variable, Function of Random Variables, Moments about the Origin: Mean, Mean squared value, and Correlation. Central Moments: Variance, Skew, and Covariance. Moment Generating Function-Properties, Characteristic Function-Properties, Chebyshev's Inequality, R.V Distributions: Gaussian Distribution, Uniform Distribution, Exponential Distribution, Rayleigh Distribution, Binomial Distribution, and Poisson Distribution. Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Joint Gaussian Random Variables, Properties, Transformation of single and multiple random variables, Linear Transformation of Gaussian Random Variables.

UNIT – III   **08L**
Random Processes – Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Non Deterministic Processes, First-Order Stationarity, Second-Order&Wide-Sense Stationarity, (N-Order), and Strict-Sense Stationarity, Statistical Independence. Ensemble Averages, Time Averages, Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Process, Poisson Random Process.

UNIT – IV   **08L**
Random Processes Spectral Characteristics & Linear System Response to Random Inputs:
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, Random Signal Response of Linear Systems: System
Response – Convolution, Mean and Mean-squared Value of Response, autocorrelation Function
of Response, Power Density Spectrum of Response, Cross-Correlation Functions of Input and
Output, Cross-Power Density Spectrums of Input and Output.

UNIT – V   **08L**
Noise Sources & Information Theory: : Resistive/Thermal Noise Source, Arbitrary Noise
Sources, Noise equivalent bandwidth, Effective Noise Temperature and 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.

TEXT BOOKS:
1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH,
    4th Edition,2001.
2. Principles of Communication systems by Taub and Schilling(TMH),2008

REFERENCE BOOKS:
1. Random Processes for Engineers-Bruce Hajck, Cambridgeunipress,2015
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and
    S. Unnikrishna Pillai, PHI, 4th Edition,2002.
3. Probability, Statistics &Random Processes-K. Murugesan, P. Guruswamy, Anuradha
    Agencies, 3^{rd}Edition,2003.
4. Signals, Systems & Communications - B.P. Lathi, B.S. Publications,2003.
5. Statistical Theory of Communication – S.P Eugene Xavier, New Age Publications,2003

20MA305BS: Laplace Transforms, Numerical Methods and Complex Variables

B.Tech. III Sem.	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

Course Objectives: To learn
1. Concept, Properties of Laplace transforms and inverse Laplace transforms.
2. Various methods to find roots of an equation and to fit the curve.
3. How to solve ordinary differential equations and integrals using numerical techniques.
4. Differentiation and integration of complex valued functions.
5. Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem and expansion of complex functions using Taylor's and Laurent's series.

Course outcomes: After learning the contents of this paper the student must be able to
1. Use the Laplace transform techniques for solving ODE.
2. Solve transcendental, non-linear and system of linear equations with appropriate numerical methods.
3. Find numerical solutions of ordinary differential equations.
4. Analyse the complex function with reference to their analyticity, Evaluate integrals using Cauchy's integral and residue theorems.

5. Taylor's and Laurent's series expansions of complex function.

UNIT-I: Laplace Transforms   10 L
Laplace transform of standard functions, First shifting theorem, Laplace transforms of functions when they are multiplied and divided by 't'. Laplace transforms of derivatives and integrals of function, Laplace transforms of special functions, Laplace transform of periodic functions. Inverse Laplace transform by different methods, Convolution theorem (without Proof), Solving ODEs by Laplace transform method.

UNIT-II: Numerical Methods-I   10 L
Solution of polynomial and transcendental equations: Bisection method, Iteration method, Newton-Raphson method and Regula-False method.
Curve Fitting: Fitting a linear, second degree, exponential, power curve by method of least squares.

UNIT-III: Numerical Methods-II   8 L
Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8 rules.
Numerical Solutions of Ordinary Differential Equations -Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of fourth order.

UNIT –IV Complex Variables (Differentiation)   10 L
Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (without proof), Milne-Thomson's method, Analytic function, Harmonic function, Finding harmonic conjugate, Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT –V   **10 L**
Complex Variables (Integration)
Line integrals, Cauchy's theorem, Cauchy's Integral formula, Cauchy's generalized Integral formula Zeros of analytic functions, singularities.
Complex Power series: Taylor's series, Laurent's series, Residues, Cauchy Residue theorem (without proof).

TEXT BOOKS :
1. Higher Engineering Mathematics, (36th Edition), B.S. Grewal, Khanna Publishers, 2010
2. Advanced Engineering Mathematics (3rd edition) by R.K. Jain & S.R.K. Iyengar, NarosaPublishing House, Delhi.
3. Introductory methods of Numerical Analysis(4th Edition), S.S. Sastry, PHI, 2005.

REFERENCE BOOKS:
1. Complex Variables and Applications (7th Edition), J. W. Brown and R. V. Churchill, Mc-Graw Hill, 2004.
2. Advanced Engineering Mathematics, (9th Edition), Erwin kreyszig,   John Wiley & Sons,2006.
3. Higher Engineering Mathematics, (11th Reprint), Ramana B.V., Tata McGraw Hill New Delhi, 2010.
4. M. K. Jain, SRK Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations , New Age International publishers.

20EC306PC: Digital System Design Lab

B.Tech. III Sem.	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Outcomes: On Completion of the course, students will be able to

1. Realization of Boolean Expressions using Gates and universal gates using appropriate experimentation setup.
2. Design and realization of Various Adder & Subtractor using appropriate experimentation setup. Combinational Circuits
3. Design and realization of Various Mux & Comparator Combinational Circuits using appropriate experimentation setup.
4. Design and realization of a Synchronous and Asynchronous counter using flip-flops using appropriate experimentation setup.
5. Design and Realization of a sequence detector-a finite state machine using appropriate experimentation setup.

Note: Implement using digital ICs, all experiments to be carried out. List of Experiments -

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Generation of clock using NAND / NOR gates
4. Design a 4 – bit Adder /Sub tractor
5. Design and realization of a 4 – bit gray to Binary and Binary to Gray Converter
6. Design and realization of an 8-bit parallel load and serial out shift register using flip-flops.
7. Design and realization of a Synchronous and Asynchronous counter using flip-flops
8. Design and realization of Asynchronous counters using flip-flops
9. Design and realization of 8x1 MUX using 2x1MUX
10. Design and realization of 4-bitcomparator
11. Design and Realization of a sequence detector-a finite state machine

Major Equipments 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. Multi meter.

20EC307PC: Electronic Devices and Circuits Lab

B.Tech. III Sem.	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

Course Outcomes:
On Completion of the course, students will be able to
1.Examine the characteristics of BJT and its applications.
2.Design various Types of BJT Amplifiers and same is verified on simulation software
3.Distinguish the characteristics of JFET, Design and analyze various JFET Amplifiers circuits.
4.Distinguish the characteristics of Feedback Amplifier Circuit and same is verified on simulation software
5.Analyze various Oscillator ciruits and same is verified on simulation software

Note:
1. Minimum of 10 experiments to be done in Hardware
2. Experiments marked with * has to be designed, simulated and verified in hardware.

List of Experiments:
1. Input and output characteristics of BJT in CB Configuration
2. Input and output characteristics of BJT in CE Configuration
3. Frequency response of Common Emitter BJT Amplifier(*)
4. Measurement of h-parameters of transistor in CB, CE, CC configurations
5. Two Stage RC Coupled Amplifier(*)
6. Cascode amplifier Circuit(*)
7. Darlington Pair Circuit
8. Frequency response of Common Source FET amplifier(*)
9. Drain and transfer characteristics of FET in CS Configuration
10. Current Shunt Feedback Amplifier Circuit(*)
11. Voltage Series Feedback Amplifier Circuit(*)
12. RC phase shift oscillator
13. Hartley and Colpitts oscillators

Major Equipment required for Laboratories:
1. Computer System with latest specifications connected
2. Window XP or equivalent
3. Simulation software-Multisim or anyequivalent simulation software
4. Regulated Power Suppliers,0-30V
5. 20 MHz, Dual Channel Cathode Ray Oscillo scopes.
6. Functions Generators-Sine and Square wave signals
7. Multi meters
8. Electronic Components

20EC308PC: Basic Simulation Lab

B.Tech. III Sem.

L	T	P	C
0	0	3	1.5

Course Outcomes:

Upon completing this course the student will be able to

1. Examine various signals and demonstrate different operations using MATLAB.
2. Evaluate the Fourier transform of a signal and Plot it's magnitude and phase spectrum.
3. Test the sampling theorem using MATLAB.
4. Examine a WSS Random process.
5. Describe the waveform synthesis using Laplace transform and plot pole zero maps in s plane and z plane.

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-Khintchine Relations.
18. Checking a Random Process for Stationarity in Widesense.

Major Equipments required for Laboratories:

1. Computer System with latest specifications connected
2. Window XP or equivalent
3. Simulation software-MATLAB or anyequivalent simulation software

20MC309GS: Gender Sensitization Lab

B.Tech. III Sem.

L	T	P	C
0	0	2	0

COURSE DESCRIPTION

This course offers an introduction to Gender Studies, an interdisciplinary field that asks 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 coursealso seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

Objectives of the Course:
1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.
6. To expose students to more egalitarian interactions between men and women.

Learning Outcomes:
1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. 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.
3. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
5. Men and women students and professionals will be better equipped to work and live together as equals.
6. Students will develop a sense of appreciation of women in all walks of life.
7. 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.

UNIT - I: Understanding Gender
Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitude stowards Gender-Construction of Gender-Socialization: Making Women, Making Men-Preparing for Womanhood. 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 Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Sharethe 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 Parks-The Brave Heart.

Note: **Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields ofEnglish 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 onGender" written* by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, 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%

20EE401ES: Network Analysis

B.Tech. IV Sem.

L	T	P	C
3	1	0	4

Pre-Requisites: Basic Electrical and Electronics Engineering

Course Objectives:
1. To understand the basic concepts of RLC circuits, network theorems and it's frequency domain analysis.
2. To understand the basics of magnetic circuits and network topology.
3. To know the behavior of the steady states and transient states in RLC circuits.
4. To study the transfer function and network functions in S domain.
5. To understand the two port network parameters and design of attenuator circuits.

Course Outcomes: Upon successful completion of the course, students will be able to:
1. Acquire the knowledge on basic RLC circuits behavior, network theorems and it's frequency domain analysis
2. Analyze the knowledge of magnetic circuits and network topology.
3. Analyze the Steady state and transient states of RLC Circuits.
4. Analyze the network functions in S domain.
5. Illustrate and analyze the knowledge of characteristics of the two port network parameters and design of attenuator circuits.

UNIT – I   **12L**

Network theorems (AC & DC): Network reduction using star-delta conversions, Super position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem.
Frequency Domain Analysis: Series and parallel Resonance - Resonance curves, Bandwidth, quality factor.

UNIT – II   **10L**

Magnetic Circuits: Self and Mutual inductances, co-efficient of coupling, dot convention, coupled circuits, , equivalent T for Magnetically coupled circuits, Ideal Transformer.
Network Topology: Definition, Incident matrix, loop matrix, Basic cut-set and tie set matrices for planar networks and network equilibrium equations.

UNIT – III   **08L**

Steady state and transient analysis of RC, RL and RLC Circuits, Circuits with switches, step response, 2nd order RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases.

UNIT – IV   **08L**

Network Analysis using Laplace transform techniques - RC, RL ad RLC circuit response for step, impulse exponential excitation and periodic excitation.

UNIT –V   **10L**

Two port network parameters, Z, Y, ABCD, h and g parameters, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros.
Attenuators: Standard T, π L Sections, Characteristic impedance, image transfer constants, Design of Attenuators.

TEXT BOOKS:

1. Network Analysis – Van Valkenburg, 3rd Ed., Pearson,2016.
2. Engineering Circuit Analysis – William Haytand Jack E Kemmerly, MGH, 8thEdition,1993.

REFERENCE BOOKS:

1. Electric Circuits – J. Edminister and M. Nahvi – Schaum's Outlines, McGraw Hill Education, 1999.
2. Networks, Lines and Fields - JD Ryder, PHI, 2ndEdition,1999.
3. Network Analysis and synthesis – Ravish R Singh – McGraw Hill education.

20EC402PC: Analog and Digital Communications

B.Tech. IV Sem.   **L   T   P   C**
                                                                                    3   0   0   3

Prerequisite: Probability theory and Stochastic Processes

Course Objectives:
1. To develop ability to analyze system requirements of analog and digital communication systems.
2. To understand the generation, detection of various analog and digital modulation techniques.
3. To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
4. To understand the concepts of baseband transmissions.

Course Outcomes: Upon completing this course, the student will be able to
1. Illustrates and design of various continuous wave and angle modulation and demodulation techniques
2. Relate the effect of noise present in continuous wave and angle modulation techniques.
3. Acquire the knowledge about AM , FM Transmitters and Receivers
4. Analyze and design the various Pulse Modulation Techniques.
5. Understand the concepts of Digital Modulation Techniques and Baseband transmission.

UNIT – I   **10L**
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   **10L**

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, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis.

UNIT – III   **08L**
Transmitters: Classification of Transmitters, AM Transmitters, FM Transmitters
Receivers: Radio Receiver - Receiver Types - Tuned radio frequency receiver, super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.

UNIT – IV   **10L**
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 Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

UNIT – V   **10L**
Digital Modulation Techniques: ASK- Modulator, Coherent ASK Detector, FSK- Modulator, Non- Coherent FSK Detector, BPSK- Modulator, 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. Analog and Digital Communications – Simon Haykin, John Wiley, 2005.
2. Electronics Communication Systems-Fundamentals through Advanced-Wayne

    Tomasi, 5th Edition, 2009, PHI.

REFERENCE BOOKS:
1. Principles of Communication Systems - Herbert Taub, Donald L Schilling, Goutam

    Saha, 3rd Edition, McGraw-Hill, 2008.
2. Electronic Communications – Dennis Roddyand John Coolean , 4thEdition, PEA,2004
3. Electronics & Communication System – George Kennedy and Bernard Davis, TMH,2004.
4. Analog and Digital Communication – K. Sam Shanmugam, Willey, 2005.

20EC403PC: Electronic Circuits and Pulse Circuits

B.Tech. IV Sem.	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Pre-requisite: Electronic Devices and Circuits

Course Objectives:
1. To understand concepts of various types of large signal amplifiers and tuned amplifiers.
2. To understand the concepts of Linear wave shaping circuits for different signals..
3. To learn the Concepts of Non-Linear wave shaping.
4. To construct various multi vibrators using transistors and UJT.
5. To understand the concepts of various sweep circuits.

Course Outcomes: Upon completing this course, the student will be able to
1. Categorize various types of large signal amplifiers and tuned amplifiers.
2. Classify and analyze the concepts of linear wave shaping circuits for different signals.
3. Understand and Analyze the Concepts of Non-Linear wave shaping circuits
4. Analyze and Design Multi vibrators for various applications.
5. Summerises sweep circuits operation and it's applications.

UNIT –I   10L
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 Amplifiers.
Tuned Amplifiers: Introduction, Single Tuned Amplifier-Quality factor, frequency response of tuned amplifier, Concepts of Stagger Tuned and Synchronous Tuning.

UNIT –II   10L
Linear Wave Shaping: Responses of RC-high pass circuit and low pass circuits to sinusoidal, step,pulse, square, ramp and exponential inputs, RC circuit as a differentiator and integrator, uncompensated and compensated attenuators, RLC circuits and their response for step input, ringing circuit.

UNIT III   10L
Non-Linear Wave Shaping: Clipping circuits with diodes, clipping at two independent levels,transfer characteristics of clippers, multi-diode circuits, transient and steady state response of a diode clamping circuit, clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, transfer characteristics of clampers.

UNIT –IV   12L
Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors. UJT Characteristics and UJT as Relaxation oscillator.

UNIT-V   8L
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.

TEXT BOOKS:
1. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw HillEducation.
2. Electronic Devices Conventional and current version -Thomas L. Floyd 2015,Pearson.
3. Pulse, Digital and Switching Waveforms, Jacob Millman, Herbert Taub, McGraw Hill, 3rd Edition.

REFERENCE BOOKS:
1. Pulse, Switching and Digital Circuits, David A. Bell, Oxford University Press (2015)
2. Electronic Devices and Circuits, David A. Bell – 5^{th}Edition,Oxford.
3. Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11^{th}Edition, 2009,Pearson.
4. Electronic Devices and Circuits -Saliva Hanan, PHI

20EC404PC: Electromagnetic Waves and Transmission Lines

B.Tech. IV Sem.   L   T   P   C
                                                               3   0   0   3

Pre-requisite: Applied Physics

Course Objectives:
1. To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magnetostatic 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 analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
4. To study the propagation, reflection and transmission of plane waves in bounded and unbounded media.

Course Outcomes: Upon completing this course, the student will be able to
1. Acquire the knowledge of Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields.
2. Distinguish between the static and time-varying fields; establish the corresponding sets of Maxwell's Equations and Boundary Conditions.
3. Analyze the Wave Equations for good conductors, good dielectrics and evaluate the UPW Characteristics for several practical media of interest.
4. Illustrate the transmission line parameters and configurations.
5. Design and Analyze transmission lines using Smith chart.

UNIT – I   **10L**
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, Maxwell's Two Equations for Electrostatic Fields, 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   **12L**
Magnetostatics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.
Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Forms, Conditions at a Boundary Surface - Dielectric-Dielectric and Dielectric-Conductor Interfaces.

UNIT – III   **08L**
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 – IV   **08L**
Transmission Lines - I: 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, Types of Distortion, Condition for Distortion less line, Minimum Attenuation, Loading - Types of Loading.

UNIT – V   **08L**
Transmission Lines – II: Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines – Impedance Transformations, Smith Chart – Configuration and Applications, Single Stub Matching.

TEXT BOOKS:
1. Principles of Electromagnetics – Matthew N.O. sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Aisan Edition,2015.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, 2nd Ed., 2000,PHI.
3. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan, 2001, (Tech. India Publications), New Delhi.

REFERENCE BOOKS:
1. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 8th Ed., McGrawHill,2014
2. Engineering Electromagnetics – Nathan Ida, 2nd Ed., 2005, Springer (India) Pvt. Ltd., New Delhi.
3. Electromagnetic field theory and transmission lines – G.Sashibhushana Rao, Wiley India, 2013.
4. Networks, Lines and Fields - JD Ryder, PHI, 2nd Edition, 1999.

20EC405PC: Linear IC Applications

B.Tech. IV Sem.	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Pre-requisite: Electronic Devices and Circuits

Course Objectives: The main objectives of the course are:
1. To introduce the basic building blocks of linear integrated circuits.
2. To introduce the theory and applications of analog multipliers and PLL.
3. To introduce the concepts of waveform generation and introduce some special function ICs.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand operational amplifiers with linear integrated circuits.
2. Discuss the various applications of Op-Amps.
3. Explain the operation of various types of filters, various types of multi-vibrators & design them
4. Understand the functional diagrams and applications of IC 555 and IC 565 and Apply them for design different application
5. Classify and analyze the operation of various types of analog to digital and digital to analog converters & Design them.

UNIT – I   **10L**
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 op-amp and its features, modes of operation-inverting, non-inverting, differential.

UNIT – II   **10L**
Op-amp and Applications: Basic information of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, Sample & hold circuits, multipliers and dividers, differentiators and integrators, comparators, Schmitt trigger, Multi vibrators, introduction to voltage regulators, features of 723

UNIT – III   **08L**
Active Filters & Oscillators: Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation - RC, Wien and quadrature type, waveform generators - triangular, sawtooth, square wave and VCO.

UNIT – IV   **08L**
Timers & Phase Locked Loops: Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565.

UNIT – V   **08L**
D-Aand A-D Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC dual slope integration type ADC, DAC and ADC specifications.

TEXT BOOKS:
1. Linear Integrated Circuits, D. RoyChowdhury, New Age International (p) Ltd.
2. Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI

REFERENCES BOOKS:

1. Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll,PHI.
2. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, Denton J. Daibey, TMH.
3. Design with Operational Amplifiers & Analog Integrated Circuits, Sergio Franco, McGrawHill.
4. Digital Fundamentals - Floyd and Jain, PearsonEducation.

20EC406PC: Analog and Digital Communications Lab

B.Tech. IV Sem.	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Outcomes: At the end of the course, the student will be able to:
1. Analyze different AM and FM Modulation & Demodulation Technique using appropriate experimentation setup
2. Design different Multiplexing Techniques using appropriate experimentation setup.
3. Design different Pulse Modulation Techniques using appropriate experimentation setup.
4. Design and analyze different Shift Keying Techniques using appropriate experimentation setup
5. Design and analyze Different Quadrature Shift Keying Techniques using appropriate experimentation setup

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

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. Frequency Shift Keying: Generation and Detection
12. Binary Phase Shift Keying: Generation and Detection
13. Generation and Detection (i) DPSK (ii) QPSK

Major Equipments 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 toolbox
6. Analog and Digital Modulation and Demodulation Trainer Kits.

20EC407PC: Electronic Circuits and Pulse Circuits Lab

B.Tech. IV Sem.	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

Course Outcomes

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

1. Analyze different power amplifiers using appropriate experimentation setup
2. Design different linear and nonlinear circuits using appropriate experimentation setup.
3. Design different nonlinear circuits using appropriate experimentation setup.
4. Design and analyze different multivibrator using appropriate experimentation setup
5. Design and analyze Miller Sweep Circuit using appropriate experimentation setup

List of Experiments:

1. RC high pass circuit as differentiator (Square wave input)
2. RC low pass circuit as integrator (Square wave input)
3. Types of Clippers at different reference voltages
4. Types of Clampers at different reference voltages
5. Transistor as a switch
6. Class A Power Amplifier
7. Class B Complementary & Symmetry Power Amplifiers
8. Bistable, Multivibrator.
9. Design a Monostable Multivibrator
10. Design an Astable Multivibrator
11. The output voltage waveform of Miller Sweep Circuit

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
4. Multimeters
5. Electronic Components/Trainer Kits.

20EC408PC: IC Applications Lab

B. Tech. IV Sem.	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

Course Outcomes
At the end of the course, the student will be able to:
1. Analyze different Modes of Operation of Op Amp using appropriate experimentation setup
2. Design and Analyze different Combinational Circuit Applications of Op Amp Circuits using appropriate experimentation setup.
3. Design and Analyze different Active filter Applications of Op Amp Circuits using appropriate experimentation setup.
4. Design and analyze different multi vibrator of Op Amp Circuits using appropriate experimentation setup
5. Design and analyze Voltage Regulator of Op Amp Circuits using appropriate experimentation setup

Note: Verify the functionality of the IC in the given application

Design and Implementation of:
1. Inverting and Non-Inverting Amplifiers using Op Amps
2. Adder and Sub tractor using Op Amp.
3. Comparators using Op Amp.
4. Integrator Circuit using IC741.
5. Differentiator Circuit using Op Amp.
6. Active filter Applications-LPF, HPF (First Order)
7. IC 741 waveform Generators-Sine, Square wave and Triangular Waves.
8. Mono-Stable Multi vibrator using IC555.
9. A stable multi vibrator using IC555.
10. Schmitt Trigger Circuits using IC741.
11. IC 565-PLLApplications.
12. Voltage Regulator using IC723
13. Three terminal voltage regulators-7805, 7809,7912

Major Equipments 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. Multi meter.

20MC409CI: Constitution of India

B.Tech. IV Sem.

	L	T	P	C
	3	0	0	0

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality

14. Scheme of the Fundamental Right to certain Freedom under Article19
15. Scope of the Right to Life and Personal Libertyunder Article21.

20EC501PC: MICROPROCESSORS AND MICROCONTROLLERS

B. Tech. V Sem.
                                           L   T   P   C
                                           3   0   0   3

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 study the basic concepts of Advanced ARM processors.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand the internal architecture, organization and assembly language programming of 8086 processors.
2. Analyze the internal architecture, organization and assembly language programming of 8051/controllers.
3. Illustrate the interfacing techniques to 8086 and 8051 based systems.
4. Understand the internal architecture of ARM processors and basic concepts of advanced ARM processors.
5. Create the real time projects using processor and controllers.

UNIT -I:
8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.
Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT -II:
Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, 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, Programming 8051 Timers and Counters.

UNIT –III:
I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.
Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

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. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition 2006.
2. ARM System Developers guide, Andrew NSLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

REFERENCE BOOKS:
1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed,2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, Andhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY2012.

20EC502PC: DATA COMMUNICATIONS AND NETWORKS

B. Tech. V Sem.   **L   T   P   C**
                                                                           3   0   0   3

Pre-requisite: Digital Communications

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: Upon completing this course, the student will be able to
1. Understand the Categories and functions of various Data communication Networks
2. Design and analyze various error detection techniques.
3. Demonstrate the mechanism of routing the data in network layer
4. Understand the significance of various Flow control and Congestion control Mechanisms
5. Understand the Functioning of various Application layer Protocols.

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 Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs -The 802.11Architecture.

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 Demultiplexing, 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.

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.

TEXTBOOKS:
1. Computer Networking A Top-Down Approach–Kurose James F, Keith W, 6th edition, Pearson

2. Data Communications and Networking Behrouz A. Forouzan 4th McGraw Hill Education.

REFERENCES:
1. Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
3. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.

20EC503PC: CONTROL SYSTEMS

B. Tech. V Sem.   **L   T   P   C**
                                                                           3   1   0   4

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

Course objectives:
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.
3. To assess the system performance using frequency domain analysis and techniques for improving the performance
4. To design various controllers and compensators to improve system performance

Course Outcomes: **At the end of this course, students will demonstrate the ability to**
1. Understand analyze the modeling of linear-time-invariant systems using transfer function.
2. Understand the concept of stability and Analyze stability for linear-time invariant systems in Time domain.
3. Understand the concept of Frequency domain representation and Analyze Stability in Frequency domain
4. Identify the needs of different types of controllers and design of PID controllers
5. Analyze Concepts of State space models.

UNT – I:
Introduction to Control Problem: Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNT – II:
Time Response Analysis of Standard Test Signals: Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second- order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNT – 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.

UNT – 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 designs.

UNT – 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 controllability and observability. Pole-placement by state feedback.

TEXT BOOKS:
1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education,1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall,1995.

REFERENCE BOOKS:
1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

20EC504PC: ANTENNAS AND WAVE PROPAGATION

B. Tech. V Sem.   **L   T   P   C**
                                                                           3   0   0   3

Pre-requisite: Electromagnetic Theory and Transmission Lines

Course Objectives:
1. To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved.
2. To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.
3. To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.
4. To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.
5. To analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.

Course Outcomes: Upon completing this course, the student will be able to
1. Analyze the different wave propagation mechanisms, determine the characteristic features of different wave propagations, and estimate the parameters involved.
2. Understand the mechanism of radiation, definitions of different antenna characteristic parameters and establish their mathematical relations.
3. Apply the concept of radiation Mechanism to Antenna arrays and arrange a setup to carry out the antenna far Field pattern and gain measurements in the laboratory
4. Design the antennas based on frequency, configure the geometry and establish the radiation patterns of VHF and UHF antennas.
5. Design the antennas based on frequency, configure the geometry and establish the radiation patterns of Microwave antennas

UNIT – I:
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.

UNIT – II:
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
Radiation, Retarded Potentials – Helmholtz Theorem.
Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave

Monopole and Half Wave Dipole–Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, 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 – III:
Antenna Arrays: Point Sources – Definition, Patterns**,** and arrays of 2 Isotropic Sources **-** Different Cases, Principle of Pattern Multiplication, and 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 - IV:
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 Mono filar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

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

TEXT BOOKS:
1. Antennas and Wave Propagation–J.D.Kraus, R.J.Marhefka and Ahmad S.Khan,TMH, New Delhi, 4th ed., (Special Indian Edition),2010.
2. Electromagnetic Waves and Radiating Systems–E.C.Jordan and K.G.Balmain, PHI, 2nd ed., 2000.

REFERENCE BOOKS:
1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Radio Engineering Handbook- Keith henney, 3rd edition ,TMH.
4. Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007.

UNIT - V:
File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection.

File System Implementation: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

TEXT BOOKS:
1. "Computer Organization" – Carl Hamacher, Zvonks Vranesic, Safea Zaky, Vth Edition, McGraw Hill.
2. "Computer Systems Architecture" – M. Moris Mano, IIIrd Edition,Pearson.
3. "Operating System Concepts"- Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, JohnWiley.

REFERENCE BOOKS:
1. "Computer Organization and Architecture" – William Stallings Sixth Edition, Pearson
2. "Structured Computer Organization" – Andrew S. Tanenbaum, 4th Edition, PHI
3. "Fundamentals of Computer Organization and Design" - Sivaraama Dandamudi , Springer Int. Edition.
4. "Operating Systems" – Internals and Design Principles, Stallings, sixth Edition–2009, Pearson Education.
5. "Modern Operating Systems", Andrew S Tanenbaum 2nd Edition,PHI.
6. "Principles of Operating Systems", B.L. Stuart, Cengage Learning, Indian Edition.

20EC512PE: ERROR CORRECTING CODES (PE - I)

B. Tech. V Sem.   **L   T   P   C**
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Prerequisite: Digital Communications

Course Objectives:
1. To acquire the knowledge in measurement of information and errors.
2. To study the generation of various code methods used in communications.
3. To study the various application of codes.

Course Outcomes: Students will be able to
1. Understand Information Model, its errors and Analyze Linear Block Codes for Detection and Correction of errors.
2. Analyze Cyclic Codes for error Detection and Correction.
3. Analyze encoding and decoding using Convolution Codes.
4. Understand the designing of turbo codes.
5. Understand the designing of Space-Time Codes.

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.
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 - II:
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 – III:
Convolution Codes: Encoding of Convolution Codes, Structural and Distance Properties, 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 – IV:
Turbo Codes: LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolution codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding

UNIT - V:
Space-Time Codes: Introduction, Digital modulation schemes, Diversity, Orthogonal space-Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing: General Concept, Iterative APP Preprocessing and

Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QL Decomposition and Interface Cancellation, Performance of Multi – Layer Detection Schemes, Unified Description by Linear Dispersion Codes.

TEXT BOOKS:
1. Error Control Coding-Fundamentals and Applications–Shu Lin,Daniel J.Costello,Jr, Prentice Hall Inc.
2. Error Correcting Coding Theory-Man Young Rhee- 1989,McGraw-Hill

REFERENCE BOOKS:
1. Error Correcting Coding Theory-Man Young Rhee-1989, McGraw – Hill Publishing,19
2. Digital Communications - Fundamental and Application - Bernard Sklar, PE.
3. Digital Communications- John G. Proakis, 5th ed., 2008,TMH.
4. Introduction to Error Control Codes – Salvatore Gravano - oxford.
5. Error Correction Coding–Mathematical Methods and Algorithms–Todd K. Moon, 2006, Wiley India.
6. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, 2009, TMH.

20EC513PE: ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (PE - I)

B. Tech. V Sem.   **L   T   P   C**
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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 Outcomes: Upon completing this course, the student will be able to
1. Understand the basic definition of measuring parameters and different meters
2. Understand various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
3. Describe the Operation of an Oscilloscope to measure various signals.
4. Explain the principle of transducer and its types to Measure various physical parameters
5. Understand the principle of Various Bridges and its types to Measure various physical parameters

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, Multi meters, 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 Edition2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition2004.

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 Education2010.

20EC505PC: MICROPROCESSORS AND MICROCONTROLLERS LAB

B. Tech. V Sem.   **L   T   P   C**
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Course Outcomes: At the end of the course the student will be able to:
1. Describe the internal organization of 8086 Microprocessor.
2. Describe the internal organization of 8051 Microcontroller.
3. Analyze the interfacing of 8086 microprocessor and 8051 microcontroller
4. Design Microprocessors / Microcontrollers-based systems.

Cycle 1: Using 8086 Processor Kits and/or Assembler (5 Weeks)
- Assembly Language Programs to 8086 to Perform
    1. Arithmetic, Logical, String Operations on 16 Bit and 32-BitData.
    2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

Cycle 2: Using 8051 Microcontroller Kit (6 weeks)
- 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 of8051.
    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 Timer08051in8bitAutoreloadModeandConnecta1HZPulsetoINT1pinandDisplay on Port 0. Assume Crystal Frequency as 11.0592MHZ

Cycle 3: Interfacing I/O Devices to 8051(5 Weeks)
1. 7 Segment Display to8051.
2. Matrix Keypad to8051.
3. Sequence Generator Using Serial Interface in8051.
4. 8 bit ADC Interface to8051.
5. Triangular Wave Generator through DAC interfaces to8051.

TEXT BOOKS:
1. Advanced Microprocessors and Peripherals by A K Ray, Tata McGraw-Hill Education,2006
2. The 8051 Microcontrollers: Architecture, Programming & Applications by Dr. K. Uma Rao, Andhe Pallavi, Pearson, 2009.

20EC506PC: DATA COMMUNICATIONS AND NETWORKS LAB

B. Tech. V Sem.   **L   T   P   C**
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Note:

A. Minimum of 12 Experiments have to be conducted
B. All the Experiments may be Conducted using Network SimulationsoftwarelikeNS-2, NSG-2.1 and Wire SHARK/equivalent software.

Note: For Experiments 2 to 10 Performance may be evaluated through simulation by using the parameters Throughput, Packet Delivery Ratio, Delay etc.

1. Writing a TCL Script to create two nodes and links between nodes
2. Writing a TCL Script to transmit data between nodes
3. Evaluate the performance of various LAN Topologies
4. Evaluate the performance of Drop Tail and RED queue management schemes
5. Evaluate the performance of CBQ and FQ Scheduling Mechanisms
6. Evaluate the performance of TCP and UDP Protocols
7. Evaluate the performance of TCP, New Reno and Vegas
8. Evaluate the performance of AODV and DSR routing protocols
9. Evaluate the performance of AODV and DSDV routing protocols
10. Evaluate the performance of IEEE 802.11 and IEEE 802.15.4
11. Evaluate the performance of IEEE 802.11 and SMAC
12. Capturing and Analysis of TCP and IP Packets
13. Simulation and Analysis of ICMP and IGMP Packets
14. Analyze the Protocols SCTP, ARP, NetBIOS, IPXVINES
15. Analysis of HTTP, DNS and DHCP Protocols

Major Equipment Required:
Required software (Open Source) like NS-2, NSG-2.1 and Wire SHARK

20EN507HS: ADVANCED COMMUNICATION SKILLS LAB

B. Tech. V Sem.   **L T P C**
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1. INTRODUCTION:
The introduction of the Advanced Communication Skills Lab is considered essential at 3rdyear level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.
The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:
- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. OBJECTIVES:
This Lab focuses on using multi-media instruction for language development to meet the following targets:
To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:
The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:
1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language –Role Play indifferent situations & Discourse Skills-using visuals-Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations &usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading &effective goggling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/e- mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group

discussion,intervention,summarizing,modulationofvoice,bodylanguage,relevance, fluencyand organization of ideas and rubrics for evaluation- Concept and process, pre- interview planning, opening strategies, answering strategies, interview throughtele-conference & video-conference and Mock Interviews.

4. MINIMUM REQUIREMENT:
The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:
- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8GHZ
- T. V, a digital stereo &Camcorder
- Headphones of High quality

5. SUGGESTED SOFTWARE:
The software consisting of the prescribed topics elaborated above should be procured and used.
- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:
1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCES:
1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007.
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012.Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw Hill, 2009.

20MC509IP: INTELLECTUAL PROPERTY RIGHTS

B. Tech. V Sem.   **L T   P C**
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UNIT – I:
Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II:
Trademarks: Purpose and function of trademarks, acquisition of trademark rights, protectable matter, selecting, and evaluating trademark, trademark registration processes.

UNIT – III:
Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV:
Trade Secrets: Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V:
New development of intellectual property: new developments in trademark 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.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company Ltd.

20EC601PC: MICROWAVE ENGINEERING

B. Tech. VI Sem.   **L   T   P   C**
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Prerequisite: Antennas and Wave Propagation

Course Objectives:
1. To get familiarized with microwave frequency bands, their applications and to understand the limitations and losses of conventional tubes at these frequencies.
2. To distinguish between different types of microwave tubes, their structures and principles of microwave power generation.
3. To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S- Matrix for various types of microwave junctions.
4. Understand the utility of Optical Fibres in Communications.

Course Outcomes: Upon completing this course, the student will be able to
1. Memorize power generation at microwave frequencies and derive the performance characteristics.
2. Realize the need for solid state microwave sources and understand the principles of solid state devices.
3. Distinguish between the different types of waveguide and ferrite components, and select proper components for engineering applications.
4. Understand the utility of S-parameters in microwave component design and learn the measurement procedure of various microwave parameters.
5. Understand the mechanism of light propagation through Optical Fibres.

UNIT – I:
Waveguides: Electromagnetic Spectrum and Bands. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Phase and Group Velocities, Wavelengths and Impedance Relations, Equation of Power Transmission, Impossibility of TEM Mode. Microstrip Lines – Z_o Relations, Effective Dielectric Constant.

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, Reentrant 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.
Helix TWTs: Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

UNIT – III:
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,
Microwave Solid State Devices: Introduction, Classification, Applications. TEDs– Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Principle of operation of IMPATT and TRAPATT Devices.

UNIT – IV:
Waveguide Components: 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, Waveguide Multiport Junctions - E plane and H plane Tees, Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator.

UNIT – V:
Scattering matrix: Scattering Matrix Properties, Directional Couplers – 2 Hole, Bethe Hole, [s] matrix of Magic Tee and Circulator.

Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions, 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 - DavidM.Pozar,JohnWiley&Sons(Asia)PvtLtd.,1989,3red.,2011 Reprint.
3. Microwave Engineering - G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012.
4. Electronic Communication System – George Kennedy, 6th Ed., McGraw Hill.

20EC602PC: DIGITAL SIGNAL PROCESSING

B. Tech. VI Sem.   **L   T   P   C**
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Prerequisite: Signals and Systems

Course Objectives:
1. To provide background and fundamental material for the analysis and processing of digital signals.
2. To understand the fast computation of DFT and appreciate the FFT processing.
3. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specifications.
4. To acquaint in Multi-rate signal processing techniques and finite word length effects.

Course Outcomes: Upon completing this course, the student will be able to
1. Familiarized the LTI system characteristics and Multirate signal processing.
2. Illustrated with the inter-relationship between DFT and various transforms.
3. Design a digital IIR Digital Filters for a given specification.
4. Design a digital FIR Digital Filters for a given specification.
5. Understand the significance of various filter structures and effects of round off errors.

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. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI,2009
2. Digital Signal Processing, Principles, Algorithms, and Applications John G.Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.

REFERENCE BOOKS:

1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier,2008
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson,2007
3. Digital Signal Processing – S. Salivahanan, A. Vallavaraj and C. Gnanapriya, TMH,2009
4. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis, 2nd Edition, Pearson Education,2009

20EC603PC: VLSI DESIGN

B. Tech. VI Sem.   **L   T   P   C**
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Prerequisite: Electronic Circuit Analysis; Digital System 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 BiCMOS 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 Outcomes: Upon completing this course, the student will be able to
1. Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
2. Draw the layout of any logic circuit which helps to understand and estimate parasitic effect of any logic circuit
3. Design of digital logics using different Static and dynamic logic Gates and measure its performance parameters
4. Design building blocks of data path systems, memories and its types .
5. Design approaches using the PLDs and Testing Techniques for faults in CMOS

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, 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.

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.

TEXT BOOKS:
1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell , PHI, 2005Edition
2. CMOS VLSI Design– A Circuits and Systems Perspective, NeilH. 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.

20EC621PE: OBJECT ORIENTED PROGRAMMING THROUGH JAVA (PE - II)

B. Tech. VI Sem.	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Prerequisites: Programming for Problem Solving.

Course Objectives:
1. Introduces object oriented programming concepts using the java language
2. Introduces the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes.
3. Introduces the implementation of packages and interfaces.
4. Introduces exception handling, event handling and multi threading.
5. Introduces the design of graphical user interface using applets and swings.

Course Outcomes:
1. Defines object oriented programming concepts using the java language
2. Understand the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes.
3. Analyze the concepts of exception handling and multithreading.
4. Understand and implement the concepts of event handling.
5. Design simple graphical user interface applications.

UNIT - I:
Object Oriented Thinking and Java Basics: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

UNIT - II:
Inheritance, Packages and Interfaces: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.
Defining, Creating and Accessing a Package, Understanding Classpath, Importing Packages, Differences between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

UNIT - III:
Exception Handling and Multithreading: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, built in Exceptions, Creating Own Exception Sub Classes. String Handling, Exploring Java. Util, Differences between Multi-Threading and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing Threads, Inter thread Communication, Thread Groups, Daemon Threads.
Enumerations, Auto boxing, Annotations, Generics.

UNIT - IV:
Event Handling: Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.
The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scroll pane, Dialogs, Menu bar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

UNIT - V:
Applets: Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.
Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- J applet, J frame and J component, Icons and Labels, Text Fields, Buttons – The J button Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:
   1. Java the Complete Reference, 7th Edition, Herbert Schildt, TMH.
   2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education.

REFERENCE BOOKS:
   1. An Introduction to Programming and OO Design using Java, J. Nino and F.A. Hosch, John Wiley &Sons.
   2. An Introduction to OOP, Third Edition, T. Budd, Pearson Education.
   3. Introduction to Java Programming, Y. Daniel Liang, Pearson Education.
   4. An Introduction to Java Programming and Object-Oriented Application Development, R.A. Johnson-Thomson.
   5. Core Java 2,Vol1,Fundamentals, Cay.S.Horstmann and Garyn Cornell, Eighth Edition, Pearson Education.
   6. Core Java 2, Vol 2, Advanced Features, Cay. S. Horstmann and Gary Cornell, eighth Edition, Pearson Education

20EC622PE: MOBILE COMMUNIATIONS AND NETWORKS(PE - II)

B. Tech. VI Sem.   **L T P C**
                                                                                   3 0 0 3
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: Upon completing this course, the student will be able to:
1. Understand the evolution of cellular and mobile communication system.
2. Understand Co-Channel and Non-Co-Channel interferences.
3. Understand impairments due to multipath fading channel and 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. Know the difference between cellular and Adhoc Networks and design goals of MAC Layer protocol.

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. Mobile Cellular Telecommunications-W.C.Y. Lee, McGraw Hill, 2nd Edn.,1989.
2. Wireless Communications - Theodore. S. Rapport, Pearson Education, 2nd Edn.,2002.

REFERENCE BOOKS:
1. Ad Hoc Wireless Networks: Architectures and Protocols-C. Siva ram Murthy and B.S. Manoj, 2004, PHI.
2. Modern Wireless Communications-Simon Haykin, Michael Moher, Pearson Education, 2005.
3. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.
4. Wireless Communications-Andrea Goldsmith, Cambridge University Press, 2005.

20EC623PE: EMBEDDED SYSTEM DESIGN (PE -II)

B. Tech. VI Sem.   **L   T   P   C**
                                                                   3   0   0   3

Prerequisite: Microprocessors and Microcontrollers; Computer Organization and Operating Systems

Course Objectives:
1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware.
3. To understand the necessity of operating systems in correlation with hardware systems.
4. To learn the methods of interfacing and synchronization for tasking.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand the selection procedure of Processors in the embedded domain.
2. Design Procedure for Embedded Firmware.
3. Visualize the role of Real time Operating Systems in Embedded Systems.
4. To evaluate the Correlation between task synchronization and latency issues.
5. Understand Task Communication/Synchronization Issues.

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: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT - IV:
RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT - V:
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.

TEXT BOOK:
  1. Introduction to Embedded Systems - Shibu K.V, McGraw Hill.

REFERENCE BOOKS:
1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013.
4. An Embedded Software Primer - David E. Simon, Pearson Education.

20EC611OE: PRINCIPLES OF ELECTRONIC COMMUNICATIONS (Open Elective - I)

B. Tech. VI Sem.	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Prerequisite: Nil

Course Objectives: The objective of this subject is to:
1. Introduce the students to modulation and various analog and digital modulation schemes.
2. They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Outcomes: Upon completing this course, the student will be able to:
1. Understand modulation need and techniques in communications and overview of electromagnetic spectrum.
2. Analyze Analog, pulse modulation, and digital modulation techniques.
3. Distinguish Various Local Area Networks and their structure.
4. Conceptualize principles and applications of satellite and optical communications.
5. Understand various cellular telephone systems and wireless technologies.

UNIT – I:
Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT – II:
Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

UNIT – III:
Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.
Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT – IV:
Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.
Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT – V:
Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.
Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

TEXT BOOKS:
1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Electronic Communications systems, Kennedy, Davis 4e, MC Graw Hill Education, 1999.

REFERENCE BOOKS:
1. Theodore Rapp port, Wireless Communications - Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Introduction to data communications and networking, Wayne Tomasi, Pearson Education, 2005.

20EC612OE: FUNDAMENTALS OF INTERNET OF THINGS (Open Elective – I)

B. Tech. VI Sem.   **L T P C**
                                                                  3 0 0 3

Course Objectives: The objectives of the course are to:
1. Understand the concepts of Internet of Things and able to build IoT applications
2. Learn the programming and use of Arduino and Raspberry Pi boards.
3. Known about data handling and analytics in SDN.

Course Outcomes: Upon completing this course, the student will be ableto:
1. Known basic protocols in sensor networks.
2. Program and configure Arduino boards for various designs.
3. Understand Python programming and interfacing for RaspberryPi.
4. Design IoT applications in different domains.
5. Analyze the various applications of IoT.

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 RaspberryPi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with RaspberryPi.

UNIT-IV:
Implementation of IoT with RaspberryPi, 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.

TEXTBOOKS:
1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C.Raman (CRCPress).
2. "Make sensors":Terokarvinen, kemo, karvinen and villeyval tokari, 1st edition, maker media,2014.
3. "Internet of Things: A Hands-on Approach",by Arshdeep Bahgaand Vijay Madisetti.

REFERENCEBOOKS:
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.

20EC604PC: DIGITAL SIGNAL PROCESSING LAB

B. Tech. VI Sem.

L	T	P	C
0	0	2	1

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

1. Perform Time, Frequency and Z- transform analysis on signals and systems.
2. Apply Z-transform, DTFT, DFT and FFT to analyze and design DSP systems.
3. Implementation of Decimation Process and Interpolation Process
4. Analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital filters.
5. Design Multi-rate filters for various applications of DSP.

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.

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.

20EC605PC: e - CAD LAB

B. Tech. VI Sem.   **L   T   P   C**
                                                                       0   0   3   1.5

Course Outcomes: At the end of the course the student will be able to:
1. Verify the functionality of Different logic gates Using Verilog HDL
2. Verify different combinational Circuits using Verilog HDL.
3. Verify different sequential circuits Verilog HDL.
4. Layout, physical verification, timing analysis of Basic logic Gate using Backend tools
5. Layout, physical verification, timing analysis of combinational Circuits.

Note: Any **SIX of** the following experiments from each part are to be conducted (Total 12)

Part - I
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-4decoder
3. Design of 8-to-1 multiplexer and 1-to-8demultiplexer
4. Design of 4 bit binary to gray code converter
5. Design of 4 bit comparator
6. Design of Full adder using 3 modeling styles
7. Design of flip flops: SR, D, JK,T
8. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter
9. Finite State Machine Design

Part-II
Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:
1. Basic logic gates
2. CMOS inverter
3. CMOS NOR/ NAND gates
4. CMOS XOR and MUX gates
5. Static / Dynamic logic circuit (register cell)
6. Latch
7. Pass transistor
8. Layout of any combinational circuit (complex CMOS logic gate).

20EC606PC: MICROWAVE ENGINEERING LAB

B. Tech VI Sem.   **L   T   P   C**
                                                                                0   0   3 1.5

Course Outcomes: At the end of the course, the student will be able to:
   1. Study the characteristics of various microwave Tubes.
   2. Analyze the various parameters of microwave devices.
   3. Distinguish between H plane, E plane and Magic Tee.
   4. Examine Isolation, Coupling factor and Directivity of directional couplers.
   5. Describe the characteristics of horn Antenna

Note: Minimum of 12 experiments to be conducted.

   1. Reflex Klystron Characteristics
   2. Gunn Diode Characteristics
   3. Directional Coupler Characteristics
   4. VSWR Measurement of Matched load
   5. VSWR measurement of with open and short circuit loads
   6. Measurement of Waveguide Parameters
   7. Measurement of Impedance of a given Load
   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. Microwave Frequency Measurement
   14. Antenna Pattern Measurements.

20MC608ES: ENVIRONMENTAL SCIENCE

B. Tech. VI Sem.   **L   T   P   C**
                                                                     3   0   0   0
Course Objectives: Upon completing this course, the student will be able to
   1. Understanding the importance of ecological balance for sustainable development.
   2. Understanding the impacts of developmental activities and mitigation measures
   3. Understanding the environmental policies and regulations

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 helps in sustainable development

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, Biomagnification, 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.
NoisePollution: 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 Problems and Global Efforts: Climate 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.

UNIT - V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects AirAct-1981, Water Act, Forest Act, Wildlife 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. Overview 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, 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 lifestyle.

TEXT BOOKS:
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:
1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008, PHI 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. Textbook of Environmental Science and Technology - Dr.M.Anji Reddy, 2007, BS Publications.

20MB701HS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B. Tech. VII Sem.

L   T   P   C
2   0   0   2

Course Objective:
1. To learn the basic business types, impact of the economy on Business and Firm specifically.
2. To analyze the Business from the Financial Perspective.

Course Outcome: The students will understand
1. The various Forms of Business and the impact of economic variables on the Business.
2. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt.
3. The Students can study the firm's financial position by analyzing the Financial Statements of a Company.

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 and 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 and 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, and Preparation of Final Accounts.

UNIT-V: Financial Analysis through Ratios: Concept of Ratio Analysis, Importance, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (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 Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, "Managerial Economics", 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.
REFERENCE BOOKS:
1. Paresh Shah, "Financial Accounting for Management", 2nd edition, Oxford Press, 2015.
2. S.N.Maheshwari, Sunil K Maheshwari,Sharad K Maheshwari, "Financial Accounting",5th edition ,Vikas Publications, 2013.

20EC731PE: ARTIFICIAL NEURAL NETWORKS (PE – III)

B. Tech. VII Sem.   **L T P C**
                                                                         3 0 0 3

Prerequisite: Nil

Course Objectives:
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: Upon completing this course, the student will be able to
1. Understand the similarity of Biological networks and Neural networks
2. Perform the training of neural networks using various learning rules.
3. Understanding the concepts of forward and backward propagations.
4. Understanding the concepts of Self-Organization Maps.
5. Understand and Construct the Hopfield models.

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. "Neural Networks a Comprehensive Foundations", Simon S Haykin, PHI Education.
2. "Introduction to Artificial Neural Systems", Jacek M. Zurada, JAICO Publishing House Ed.2006.

REFERENCE BOOKS:
1. Neural Networks in Computer Inteligance, Li Min Fu TMH2003
2. Neural Networks -James A Freeman David M S Kapura Pearson Ed.,2004.
3. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd2005

20EC732PE: SCRIPTING LANGUAGES (PE – III)

B. Tech. VII Sem.   **L T P C**
                                                                               3 0 0 3

Prerequisites: Computer Programming and Data Structures

Course Objectives:
1. Able to differentiate scripting and non- scripting languages.
2. To learn Scripting languages such as PERL, TCL/TK, python and BASH.
3. Expertise to program in the Linux environment.
4. Usage of scripting languages in IC design flow.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand basics of Linux and Linux Networking.
2. Understand how to use Linux environment and write programs for automation
3. Understand the concepts of Scripting languages
4. Create and run scripts using PERL/TCl.
5. Create and run scripts using Python.

UNIT – I: Linux Basics
Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts.

UNIT – II: Linux Networking
Introduction to Networking in Linux, Network basics & Tools, File Transfer Protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.

UNIT – III: Perl Scripting.
Introduction to Perl Scripting, working with simple values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting, References & Subroutines, Running and Debugging Perl, Modules, Object – Oriented Perl.

UNIT – IV: Tcl / Tk Scripting
Tcl Fundamentals, String and Pattern Matching, Tcl Data Structures, Control Flow Commands, Procedures and Scope, Evel, Working with Unix, Reflection and Debugging, Script Libraries, Tk Fundamentals, Tk by examples, The Pack Geometry Manager, Binding Commands to X Events, Buttons and Menus, Simple Tk Widgets, Entry and List box Widgets Focus, Grabs and Dialogs.

UNIT – V: Python Scripting.
Introduction to Python, using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.

TEXT BOOKS:
1. Practical Programming in Tcl and Tk by Brent Welch, Updated for Tcl 7.4 and Tk4.0.
2. Red Hat Enterprise Linux 4 : System Administration Guide Copyright, Red Hat Inc,2005.

REFERENCE BOOKS:

1. Learning Python – Mark Lutz and David Ascher, 2nd Ed. , O'Reilly,2003.
2. Learning Perl – 4th Ed. Randal Schwartz, Tom Phoenix and Brain d foy.2005.
3. Python Essentials – Samuele Pedroni and Noel Pappin. O'Reilly,2002.
4. Programming Perl – Larry Wall, Tom Christiansen and John Orwant, 3rd Edition, O'Reilly, 2000. (ISBN0596000278)

20EC733PE: DIGITAL IMAGE PROCESSING (PE – III)

B. Tech. VII Sem.   **L   T   P   C**
                                                                                    3   0   0   3

Prerequisite: Digital Signal Processing

Course Objectives:
1. To provide a approach towards image processing and introduction about 2Dtransforms
2. To expertise about enhancement methods in time and frequency domain
3. To expertise about segmentation and compression techniques
4. To understand the Morphological operations on an image

Course Outcomes: Upon completing this course, the student will be able to
1. Explore the fundamental relations between pixels and utility of 2-D transforms in image processer.
2. Understand the enhancement, segmentation and restoration processes on an image.
3. Implement the various Morphological operations on an image.
4. Understand the need of compression and evaluation of basic compression algorithms.
5. Understand the Morphological operations on an image.

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 2000Standards.

TEXT BOOKS:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson,2008
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- TMH,2010.

REFERENCE BOOKS:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools - Scotte Umbaugh, 2nd Ed, CRC Press,2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and StevenL. Eddings, 2nd Edition, TMH, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, 2nd Edition, BS Publication,2008.

20EC741PE: BIOMEDICAL INSTRUMENTATION (PE – IV)

B. Tech. VII Sem.   **L T P C**
                                                                   3 0 0 3

Course Objectives
1. Identify significant biological variables at cellular level and ways to acquire different bio-signals.
2. Elucidate the methods to monitor the activity of the heart, brain, eyes and muscles.
3. Introduce therapeutic equipment for intensive and critical care.
4. Outline medical imaging techniques and equipment for certain diagnosis and therapies.

Course Outcomes: After completion of the course the student is able to:
1. Understand bio systems and medical systems from an engineering perspective.
2. Identify the techniques to acquire record and primarily understand physiological activity of the human body through cell potential, ECG, EEG, BP and blood flow measurement and EMG.
3. Understand the working of various medical instruments and critical care equipment.
4. Identify the imaging techniques including CT, PET, SPECT and MRI used in diagnosis of various medical conditions.
5. Understand about therapeutic Equipment.

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, Hemodialysis 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. "Hand-book of Biomedical Instrumentation", R.S. Khandpur, McGraw-Hill, 2003.
2. "Medical Instrumentation, Application and Design", John G. Webster, JohnWiley.

REFERENCE BOOKS:
1. "Biomedical Instrumentation and Measurements", Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, PHI.
2. "Principles of Applied Biomedical Instrumentation", L.A.Geoddes and L.E.Baker, John Wiley and Sons.
3. "Introduction to Biomedical equipment technology", Joseph Carr and Brown.

20EC742PE: DATABASE MANAGEMENT SYSTEMS (PE – IV)

B. Tech. VII Sem.   **L   T   P   C**
                                                                               3   0   0   3

Prerequisite: Data Structures

Course Objectives:
1. To understand the basic concepts and the applications of data base systems.
2. To master the basics of SQL and construct queries using SQL.
3. Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

Course Outcomes: Upon completing this course, the student will be able to
1. Gain knowledge of fundamentals of DBMS and its applications.
2. Understand the concepts of relational models.
3. Master the basics of SQL for retrieval and management of data.
4. Be acquainted with the basics of transaction processing and concurrency Control.
5. Familiarity with database storage structures and access techniques.

UNIT – I:
Database System Applications: A Historical Perspective, File Systems versus a DBMS**,** the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS.
Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model.

UNIT – II:
Introduction to the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views, Relational Algebra**,** Tuple relational Calculus, Domain relational calculus.

UNIT – III:
SQL: Queries, Constraints, Triggers: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active databases.
Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

UNIT – IV:
Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

UNIT – V:

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning, Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.

TEXT BOOKS:
1. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, Tata Mc GrawHill
    3rd Edition.
2. "Database System Concepts", Silberschatz, Korth, Mc Graw hill, 5th edition.

REFERENCE BOOKS:
1. "Database Systems design, Implementation, and Management", Peter Rob & Carlos Coronel 7th Edition.
2. "Fundamentals of Database Systems", Elmasri Navrate, Pearson Education.
3. "Introduction to Database Systems", C. J. Date, Pearson Education.
4. "Oracle for Professionals", The X Team, S.Shah and V. Shah,SPD.
5. "Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL",Shah,PHI.
6. "Fundamentals of Database Management Systems", M. L. Gillenson, Wiley Student Edition.

20EC743PE: NETWORK SECURITY AND CRYPTOGRAPHY (PE – IV)

B. Tech. VII Sem.   **L   T   P   C**
                                                               3   0   0   3

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 counter measures.
3. To understand Authentication functions with Message Authentication Codes and Hash Functions.
4. To provide familiarity in Intrusion detection and Firewall Design Principles.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand network security fundamental concepts and principles.
2. Create Encrypted and decrypted messages using block ciphers and network security technology and protocols.
3. Analyze key agreement algorithms to identify their weaknesses.
4. Identify and assess different types of threats, malware, spyware, viruses, and vulnerabilities.
5. Understand IP security and firewall.

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 digests 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. "Cryptography and Network Security: Principles and Practice", William Stallings, Pearson Education.
2. "Network Security: The complete reference", Robert Bragg, Mark Rhodes,TMH, 2004.

REFERENCE BOOKS:
1. "Network Security Essentials (Applications and Standards)", William Stallings Pearson Education.
2. "Fundamentals of Network Security", Eric Maiwald (Dream tech press)
3. "Principles of Information Security", Whitman, Thomson.
4. "Introduction to Cryptography", Buchmann, Springer.

20EC751PE: SATELLITE COMMUNICATIONS (PE – V)

B. Tech. VII Sem.   **L   T   P   C**
                                                             3   0   0   3

Prerequisite: Analog and Digital Communications

Course Objectives:
1. To acquired foundation in orbital mechanics and launch vehicles for the satellites.
2. To provide basic knowledge of link design of satellite.
3. To understand multiple access systems and earth station technology.
4. To understand the concepts of satellite navigation and GPS.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles.
2. Envision the satellite sub systems and design satellite links for specified C/N.
3. Understand the various multiple access techniques for satellite communication systems and earth station technologies.
4. Know the concepts of LEO, GEO Stationary Satellite Systems and satellite navigation.
5. Understand mapping the geospatial features.

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.

Overview of 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. "Satellite Communications", Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.

2. "Satellite Communications Engineering", Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.

REFERENCE BOOKS:
1. "Satellite Communications: Design Principles", M.Richharia, BS Publications, 2nd edition,2003.
2. "Satellite Communication", D.C Agarwal, Khanna Publications, 5th edition.
3. "Fundamentals of Satellite Communications", K.N. Raja Rao, PHI, 2004.
4. "Satellite Communications", Dennis Roddy, McGraw Hill, 4th edition, 2009.

20EC752PE: RADAR SYSTEMS (PE – V)

B. Tech. VII Sem.   **L   T   P   C**
                                                               3   0   0   3

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 explain the designing of a Matched Filter in radar receivers.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand the basic concepts of Radar and derive complete radar range equation.
2. Understand the need and functioning of CW, FM-CW and MTI Radars
3. Analyze various Tracking methods.
4. Analyze and derive the matched filter response characteristics for radar receivers.
5. Understand detection of radar signals in noise.

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. "Introduction to Radar System", Merrill I. Skolnik, TMH Special Indian Edition, 2nd edition, 2007.

REFERENCE BOOKS:

1. "Radar: Principles, Technology, Applications", Byron Edde, Pearson Education,2004.

2. "Radar Principles", Peebles, Jr., P.Z., Wiley, New York, 1998.

3. "Principles of Modern Radar: Basic Principles", Mark A. Richards, James A. Scheer, William

   A. Holm, Yesdee, 2013.

4. "Radar Handbook", Merrill I. Skolnik, 3rd edition, McGraw Hill Education, 2008.

20EC753PE: WIRELESS SENSOR NETWORKS (PE – V)

B. Tech. VII Sem.

L T P C
3 0 0 3

Prerequisite: Analogue and Digital Communications

Course Objectives:
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. Analyze and compare various architectures of Wireless Sensor Networks.
2. Understand Design issues and challenges in Wireless Sensor Networks.
3. Design, Simulate and Compare the performance of various routing and MAC protocols.
4. Analyze and compare various data gathering and data dissemination methods.
5. Analyze the design Principles for WSNs and Role of Gateway.

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, B-MAC 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 Gold smith, Cambridge University Press, 2005.
3. "Mobile Cellular Communication", Gottapu Sasibhushana Rao, Pearson Education, 2012.
4. "Wireless Communication and Networking", William Stallings, PHI, 2003.

20EC721OE: ELECTRONIC SENSORS (Open Elective - II)

B. Tech. VII Sem.   L T P C
                                                                      3 0 0 3

Course Objectives:
1. Learn the characterization of sensors.
2. Known the working of Electromechanical, Thermal, Magnetic and radiation sensors. Understand the concepts of Electro analytic and smart sensors.
3. Able to use sensors in different applications.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand sensor Principle, Classification and Characterization.
2. Explore the working of Electromechanical, Thermal, Magnetic, Radiation.
3. Understand Electro analytical sensors.
4. Understand the basic concepts of Smart Sensors.
5. Design a system with sensors.

UNIT-I:
Sensors/Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.
Electro mechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types, 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, X-ray 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 ceramic sin 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, Aravind Raghu, CRC press, 2011.

REFERENCE BOOKS:
1. "Sensors and Actuators", D. Patranabis, 2nd edition, PHI, 2013.
2. "Make sensors", Tero karvinen, kemo,karvinen and villey valtokari,1st edition, maker media, 2014.
3. "Sensors handbook" Sabrie soloman, 2nd edition, TMH, 2009.

20EC722OE: MICROPROCESSORS AND MICROCONTROLLERS (Open Elective - II)

B. Tech. VII Sem.   **L   T   P   C**
Prerequisite: Nil   **3   0   0   3**

Course Objectives:
1. To familiarize the architecture of microprocessors and micro controllers
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors

Course Outcomes: Upon completing this course, the student will be able to
1. Understand the internal architecture, organization and assembly language programming of 8086 processors.
2. Understand the internal architecture, organization and assembly language programming of 8051/controllers.
3. Apply different interfacing techniques to 8086 and 8051 based systems.
4. Understand the internal architecture of ARM processors.
5. Understand the basic concepts of advanced ARM processors.

UNIT -I:
8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.
Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT -II:
Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, 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, Programming 8051 Timers and Counters

UNIT –III:
I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.
Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

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,

TEXT BOOKS:
1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2ndEdition 2006.
2. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT,Elsevier, 2012.

REFERENCE BOOKS:
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.

20EC702PC: SCRIPTING LANGUAGES LAB

B. Tech. VII Sem.   **L   T   P   C**
                                                                         0   0   2   1

Prerequisites: Any High-level programming language (C, C++)

Course Objectives:
1. To Understand the concepts of scripting languages for developing web-based projects
2. To understand the applications the of Ruby, TCL, Perl scripting languages

Course Outcomes:
1. Ability to understand the differences between Scripting languages and programming languages
2. Able to gain some fluency programming in Ruby, Perl, TCL

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 to1
7. Write a Ruby script to check two integers and return true if one of them is 20 otherwise return their sum
8. WriteaRubyscripttochecktwotemperaturesandreturntrueifoneislessthan0andtheother is greater than100
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 to10
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)Unshift 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

20EC801HS: PROFESSIONAL PRACTICE, LAW AND ETHICS

B. Tech. VIII Sem.   **L   T   P   C**
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Course Objectives:
1. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
2. To develop some ideas of the legal and practical aspects of their profession.

Course Outcome: The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen

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. "Professional Ethics", R. Subramanian, Oxford University Press, 2015.
2. "Legal Aspects of Business", Ravinder Kaur, 4th edition, Cengage Learning, 2016.

REFERENCE BOOKS:
1. RERA Act, 2017.
2. "Intellectual Property Rights", Wadhera, Universal Law Publishing Co., 2004.
3. "Intellectual Property Rights Law in India", T. Ramappa, Asia Law House, 2010.
4. "Law of Industrial Disputes", O.P. Malhotra, N.M. Tripathi Publishers.

20EC861PE: SYSTEM ON CHIP ARCHITECTURE (PE – VI)

B. Tech. VIII Sem.   **L T P C**
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Prerequisite: Embedded System Design

Course Objective:
1. To introduce the architectural features of system on chip.
2. To imbibe the knowledge of customization using case studies.

Course Outcomes: At the end of the course, the student will be able to:
1. Understand SOC Architectural features.
2. Acquire the knowledge on processor selection criteria and limitations.
3. Acquire the knowledge of memory architectures on SOC.
4. Understand the interconnection strategies and their customization on SOC.
5. Understand about reconfigurable devices.

UNIT – I:
Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT – II:
Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT – III:
Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I , and D – Caches , Multilevel Caches, Virtual to real translation, SOC Memory System , Models of Simple Processor – memory interaction.

UNIT – IV:
Interconnect Customization: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time, SOC Customization.

UNIT – V:
Configuration: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

TEXTBOOK:

1.   "Global positioning systems, Inertial Navigation and Integration", Mohinder S.Grewal, Lawrence R.Weill, Angus P.Andrews, Wiley, 2007.

REFERENCE:

1. "Understanding GPS Principles and Applications", E.D.Kaplan, Christopher J.Hegarty, Artech House Boston, 2005.

20EC862PE: LOW POWER VLSI DESIGN (PE – VI)

B. Tech. VIII Sem.   **L   T   P   C**

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Prerequisite: VLSI Design

Course Objectives:
1. Known the low power low voltage VLSI design.
2. Understand the impact of power on system performances.
3. Known about different Design approaches.
4. Identify suitable techniques to reduce power dissipation in combinational and sequential circuits.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand the need of Low power circuit design.
2. Understand the various architectural approaches.
3. Analyze Low-Voltage Low-Power combinational circuits.
4. Design Low-Voltage Low-Power combinational circuits
5. Understand the design of Low-Voltage Low-Power Memories.

UNIT - I
Fundamentals: Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT - II
Low-Power Design Approaches: Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches.
Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, and Mask level Measures.

UNIT - III
Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adders Architectures Ripple Carry Adders, Carry Look- Ahead Adders, Carry Select Adders, Carry Save Adders, Low- Voltage Low-Power Design Techniques –Trends of Technology and Power Supply Voltage, Low- Voltage Low-Power Logic Styles.

UNIT - IV
Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT -V:
Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

TEXT BOOKS:
1. "CMOS Digital Integrated Circuits", Analysis and Design – Sung-MoKang, Yusuf Leblebici, TMH, 2011.
2. "Low-Voltage, Low-Power VLSI Subsystems", Kiat-Seng Yeo, KaushikRoy, TMH Professional Engineering.

REFERENCE BOOKS:
1. "Introduction to VLSI Systems: A Logic, Circuit and SystemPerspective", Ming-BO Lin, CRC Press, 2011.
2. "Low Power CMOS VLSI Circuit Design", Kaushik Roy, Sharat C.Prasad, John Wiley & Sons, 2000.
3. "Practical Low Power Digital VLSI Design", Gary K. Yeap, KluwerAcademic Press, 2002.
4. "Leakage in Nanometer CMOS Technologies", Siva G. Narendran,Anatha Chandrakasan, Springer, 2005.

20EC863PE: GLOBAL POSITIONING SYSTEM (PE –VI)

B. Tech. VIII Sem.   **L   T   P C**
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Prerequisite: Analog and Digital communications
Course Objective:
1. Describe the fundamental theory and concepts of the Global Positioning System.
2. Calculate GPS satellite orbit positions and velocities.
3. Calculate user position using GPS pseudo range data.
4. Calculate and analyze error sources for GPS user position calculations.
5. Correct GPS user position errors by using local area Differential GPS.
6. Organize and write technical reports.
7. Organize and make technical presentations.

Course Outcomes: At the end of the course, the student will be able to:
1. Identify GPS components and their functions.
2. Understand GPS survey methods.
3. Interpret the navigational message and signals received by the GPS satellite.
4. Identify error sources in GPS observations, and apply the corrections for accurate positioning.
5. Understand the Mapping of geospatial features.

UNIT – I:
Introduction: Basic concept, system architecture, GPS and GLONASS Overview, Satellite Navigation, Time and GPS, User position and velocity calculations, GPS, Satellite Constellation, Operation Segment, User receiving Equipment, Space Segment Phased development..

UNIT – II:
Signal Characteristics: GPS signal components, purpose, properties and power level, signal acquisition and tracking, Navigation information extraction, pseudo range estimation, frequency estimation, GPS satellite position calculation, Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

UNIT – III:
GPS Receivers & Data Errors: Receiver Architecture, receiver design options, Antenna design, GPS error sources, SA errors, propagation errors, ionospheric error, tropospheric error, multipath, ionospheric error, estimation using dual frequency GPS receiver, Methods of multipath mitigation, Ephemeris data errors, clock errors.

UNIT – IV:
Differential GPS: Introduction, LADGPS, WADGPS, Wide Area Augmentation systems, GPS aided Geo augmented navigation (GAGAN) architecture, IRNSS , GEO Uplink subsystem, GEO downlink systems, Geo Orbit determination, Geometric analysis, covariance analysis.

UNIT – V:

GPS Applications: GPS in surveying, Mapping and Geographical Information System, Precision approach Aircraft landing system, Military and Space application, intelligent transportation system. GPS /INS Integration.

GPS orbital parameters, description of receiver independent exchange format (RINEX) , Observation data and navigation message data parameters, GPS position determination, least squares method.

TEXTBOOK:
1. "Global positioning systems, Inertial Navigation and Integration", Mohinder S.Grewal, Lawrence R.Weill, Angus P.Andrews, Wiley, 2007.

REFERENCE:
1. "Understanding GPS Principles and Applications", E.D.Kaplan, Christopher J.Hegarty, Artech House Boston, 2005.

20EC831OE: MEASURING INSTRUMENTS (Open Elective - III)

B. Tech. VIII Sem.	**L**	**T**	**P**	**C**
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Prerequisite: Nil

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: After Completion of the course the student is able to
1. Identify suitable sensors and transducers for real time applications.
2. Translate theoretical concepts into working models.
3. Understand the basic of measuring device and use them in relevant situation.
4. Understand the flow, density and viscosity measurements.
5. Understand how to use the measuring devices in metrology.

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.

20EC832OE: EMBEDDED SYSTEMS (Open Elective -III)

B. Tech. VIII Sem.   **L   T   P   C**

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Prerequisite: Nil

Course Objectives:
1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware.
3. To understand the necessity of operating systems in correlation with hardware systems.
4. To learn the methods of interfacing and synchronization for tasking.

Course Outcomes: Upon completing this course, the student will be able to
1. Understand the selection procedure of Processors in the embedded domain.
2. Design Procedure for Embedded Firmware.
3. Visualize the role of Real time Operating Systems in Embedded Systems.
4. To evaluate the Correlation between task synchronization and latency issues.
5. Understand Task Communication/Synchronization Issues.

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.

UNIT - III:
Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT - IV:
RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT - V:
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.

TEXT BOOK:
1. Introduction to Embedded Systems - Shibu K.V, McGraw Hill.

REFERENCE BOOKS:
5. Embedded Systems - Raj Kamal, TMH.
6. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
7. Embedded Systems – Lyla, Pearson, 2013.
8. An Embedded Software Primer - David E. Simon, Pearson Education.