ACADEMIC REGULATIONS

COURSE STRUCTURE

AND

DETAILED SYLLABUS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(Applicable for batches admitted from 2020-2021)

VVIT

VASIREDDY VENKATADRI
INSTITUTE OF TECHNOLOGY

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

(Autonomous)

Approved by AICTE, Permanently Affiliated to JNTUK,

NAAC Accredited with 'A' Grade, ISO 9001:2015 Certified

Nambur (V), Pedakakani (M), Guntur (Dt.), Andhra Pradesh – 522 508

ACADEMIC REGULATIONS (R20) FOR B. TECH. (REGULAR/HONORS/MINOR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2020-21 onwards

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

VISION

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

MISSION

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

OBJECTIVES

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

About ECE Department

- The department of Electronics and Communication Engineering (ECE) was established during the inception of the institute in 2007 with an annual intake of 60 students. In the academic year 2009-2010 the intake capacity rose to 120 and in theyear2013-2014itrose to 180.The department has a faculty student ratio of 1:15 as per AICTE norms. The average teaching experience is more than 5 years. So far around 2000 students have graduated. Every year our students secure placements in reputed companies like INFOSYS,TCS,TECH MAHINDRA,EFFTRONICS and VEDA IIT etc.
- The department also offers two post graduate programs in VLSI& Embedded systems and Digital Electronics and Communication Systems (DECS) with an intake of 18 in each specialization. The major goal of the department of ECE is to produce highly knowledgeable, competent and resourceful young engineers who can perform well in a wide variety of job profiles. To achieve this goal the department is putting dedicated efforts in nurturing a strong foundation both in analytical and technological aspects laid down in the curriculum. It also provides ample opportunities to students to work on mini projects, develop communication skills, explore internship opportunities in industry and take part in national and international design contests.
- The laboratory practical classes are conducted in a systematic manner, where complete plan is given at the time of commencement of the semester. The laboratories are well equipped with modern training facilities that cater to the requirements of the university syllabus. This department plays a vital role in training students of other branches of engineering too.
- The department also encourages students to take up Graduate Aptitude Test for Engineers(GATE), Graduate Record Examination (GRE) during their final year so they can pursue their higher education either in India or countries like USA, UK, Canada, Australia etc.The department has an active ECE students' forum VOICE (VVIT Organization of Innovative Communication Engineers)along with IEEE and IETE student chapters where students learn to do projects and organize technical events like symposiums, paper presentations to inculcate a broader perceptive on the profession. These efforts have culminated in the form of placements in various leading industries and organizations.

Department Vision

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

Department Mission

- To educate students with a practical approach to do vetail them to industry-needs.
- To govern the institution with a proactive and professional management with passionate teaching faculty.
- To provide holistic and integrated education and achieve overall development of Students by imparting scientific and technical, social and cognitive, managerial and organizational skills.
- To compete with the best and be the most preferred institution of the studious and the scholarly.
- To serve the community as disciplined responsible citizens in a rapidly changing and expanding global community.
- To forge strong relationships and linkage with the industry.

ACADEMIC REGULATIONS (R20) FOR B. TECH. (REGULAR)

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

   i. A student shall be declared eligible for award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.

   ii. The student shall register for 160 credits and must secure all the 160 credits.

   Award of B. Tech. (Honor)/B. Tech. (Minor): A student shall be eligible for the award of B. Tech degree with Honors or Minor if the student earns 20 additional credits are acquired as per the regulations/guidelines. The regulations/guidelines are separately provided. Registering for an Honors/Minor is optional.

2. **Courses of Study:** The following courses of study are offered at present as specializations for theB. Tech. Courses

S. No.	Branch	Branch Short Form	Branch Code
1	Civil Engineering	CIV	01
2	Electrical and Electronics Engineering	EEE	02
3	Mechanical Engineering	MEC	03
4	Electronics and Communication Engineering	ECE	04
5	Computer Science and Engineering	CSE	05
6	Information Technology	INF	12
7	CSE (Artificial Intelligence and Machine Learning)	CSM	42
8	CSE (Internet of Things and Cyber Security with Block Chain Technology)	CIC	47
9	CSE (Internet of Things)	CSO	49
10	Artificial Intelligence and Data Science	AID	54
11	Artificial Intelligence and Machine Learning	AIM	61

3. **Medium of Instruction:** The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in English only.

4. **Admissions:** Admission to the B. Tech Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or on the basis of any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

5. Structure of the Undergraduate Engineering program: Every course of B. Tech. Program shall be placed in one of the nine categories as listed in table below:

S.No.	Category	Breakup of Credits
1	Humanities and Social Science including Management courses	10.5 - 12
2	Basic Science Courses	21 - 25
3	Engineering Science Courses	24
4	Professional core Courses	48 - 51
5	Open Elective Courses	12 - 18
6	Professional Elective Courses	15 - 18
7	Internship, Seminar, Project Wok	15 – 16.5
8	Mandatory Courses	NC
9	Skill Oriented Courses	----
	Total Credits	160

** Breakup of Credits based on AICTE /APSCHE

Assigning of Credits

- Hr. Lecture (L) per week - 1 credit
- Hr. Tutorial (T) per week - 1 credit
- Hr. Practical (P) per week - 0.5 credits

6. Programme Pattern:

a) Total duration of the of B. Tech (Regular) Programme is four academic years

b) Each Academic year of study is divided into Two Semesters.

c) Minimum number of instruction days in each semester is 90.

d) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

e) The total credits for the Programme is 160.0

f) Athree-week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.

g) Student is introduced to "Choice Based Credit System (CBCS)".

h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)

i) A student has to register for all courses in a semester.

j) All the registered credits will be considered for the calculation of final CGPA.

k) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.

l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.

m) All the students shall be mandatorily registered for NCC, NSS activities and Community Service Project as per the Government and University norms.

n) Courses like Environmental Science, Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Science is to be offered compulsorily as mandatory course for all branches.

n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration/career growth/ placements/opportunities for higher studies/GATE/other competitive exams etc.

8. Registration for Courses

i. The college shall invite registration forms from the students at the beginning of the semester for the registration for courses each semester.

The registration process shall be closed within one week. If any student wishes to withdraw the registration, he/she shall submit a letter to the principal through the class teacher/instructor and HOD. The principal shall communicate the registration and withdraw details courses of each student in a consolidated form to the college examination section and University without fail.

ii. There are four open electives in each branch. All Open Electives are offered to students of all branches in general. A student shall choose an open elective, by consulting the HOD/advisor, from the list in such a manner that he/she has not studied the same course in any form during the Programme. The college shall invite registration forms from the students at the beginning of the semester for offering professional and open elective courses. There shall be a limit on the minimum and maximum number of registrations based on class/section strength.

iii. A student shall be permitted to pursue up to a maximum of two elective courses under MOOCs during the programme. Enrollment of MOOC course will be initiated from the date of commencement of class work for Second Year – 2nd Semester. Students are advised to register for only for minimum 12 weeks in duration MOOCs courses. Student has to pursue and acquire a certificate for a MOOC course only from the SWAY/NPTE through online with the approved by the BoS in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester. The details of the MOOCs courses registered by the students shall be submitted to the University examination center as well as college examination center. The Head of the Department shall appoint a mentor for each of the MOOC subjects registered by the students to monitor the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. MOOC course completion certificate must be submitted on or before the completion of Fourth Year – 1st Semester to consider it for Regular evaluation. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

iv. Two summer internships each with a minimum of six weeks duration shall be mandatorily done/completed respectively at the end of second

and third years (during summer vacations). The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs. After completing the summer internship, the students shall register in the immediate respective odd semester and it will be evaluated at the end of the semester as per norms of the autonomy. The student has to produce the summer internship satisfactory report and certificate taken from the organization to be considered for evaluation. The College shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

v. In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

vi. Curricular Framework for Skill oriented courses

a. There are five (05) skill-oriented courses shall be offered during III to VII semesters and students must register and pass the courses successfully.

b. For skill oriented/skill advanced course, one theory and 2 practical hours (1-0-2) or two theory hours (2-0-0) may be allotted as per the decision of concerned BOS.

c. Out of the five skill courses; (i) two shall be skill-oriented courses from the same domain and shall be completed in second year (ii) Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining two shall be skill-advanced courses either from the same domain or job-oriented skill courses, which can be of inter disciplinary nature.

d. Students may register the interdisciplinary job-oriented skill courses based on the prerequisites and eligibility in consultation with HoD of the college.

e. The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered

by industries/Professional bodies/APSSDC or any other accredited bodies. However, the department has to assign mentors in the college to monitor the performance of the students.

f. If a student chooses to take a certificate course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the department, then the department shall mark overall attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate. However, the student is deemed to have fulfilled the attendance requirement of the course, if the external agency issues a certificate with satisfactory condition. If the certificate issued by external agency is marked with unsatisfactory condition, then the student shall repeat the course either in the college or at external agency. The credits will be awarded to the student upon producing the successful course completion certificate from the agency/professional bodies and after passing in the viva-voce examination conducted at college as per BoS norms at the end of the semester.

9. Attendance Requirements:

i. A student is eligible to write the University examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.

ii. Shortage of Attendance below 65% in aggregate shall in NO case be condoned. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end semester examination of that class and their registration shall stand cancelled.

iii. Condonation for 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.

iv. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.

v. A student will be promoted to the next semester if he satisfies the (a) attendance requirement of the present semester and (b) minimum required credits (from Vth Semester onwards).

vi. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

vii. For induction programme attendance shall be maintained as per AICTE norms.

viii. For non-credit mandatory courses the students shall maintain the attendance similar to credit courses.

10. Evaluation-Distribution and Weightage of marks

Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the Academic Council of the institute from time to time.

i. A student is deemed to have satisfied the minimum academic requirements if he/she has earned the credits allotted to each theory/practical design/drawing subject/ project etc. by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the sum total of the internal marks and end semester examination marks together.

ii. For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

iii. **Distribution and Weightage of marks:** The assessment of the student's performance in each course will be based on Continuous Internal Evaluation (CIE) and Semester-End Examination (SEE). The performance of a student in each semester shall be evaluated subject–wise with a maximum of 100 marks for theory subject, 50 marks for practical subject/Mini Project/Internship/Industrial Training/ Skill Development programmes/Research Project, and 200 marks for end Project Work.

iv. Guide lines for Continuous Internal Evaluation (CIE)

a. For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (ii) one descriptive examination (iii) one assignment and (iv) one Subject Seminar. The online examination (objective) shall be 10 marks with duration of 20 minutes, descriptive examination shall be for 10 marks with a duration of 1 hour 30 minutes, assignment test shall be 5 marks with duration of 50 minutes (Open book system with questions of L4 standard on Bloom's scale) for objective and Subject Seminar 5 marks.

b. The first online examination (objective) is set with 20 multiple choice questions for 10 marks (20 questions x 1/2 marks) from first two and half units (50% of the syllabus).

c. The descriptive examination is set with 3 full questions for 10 marks each from first two and half units (50% of the syllabus), the student has to answer all questions.

d. The Assignment Test from first two and half units conducted for 20 Marks and will be scaled down to 5 Marks. The test is open book system and the duration of the exam is 50 minutes. Students can bring a maximum of three printed text books related to that subject. (Soft copies of the text books will not be allowed.) The assignments have to provide broadened exposure to the course. The questions shall include problem solving approach, problem analysis & design, implementation, case studies etc.

e. For the subject seminar 5 marks, each student shall be evaluated based on the presentation on any topic of his/her choice in the subject duly approved by the faculty member concerned.

f. For the subject having design and / or drawing (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests).

In the similar lines, the mid-2 examinations shall be conducted on the rest of the syllabus.

g. For practical subjects there shall be continuous evaluation during the semester for 25 marks. The internal 25 marks shall be awarded as follows: day to day work 5 marks, Record 5 marks and the remaining 15 marks are to be awarded by conducting an internal laboratory test of 3 hours duration.

h. The mid marks submitted to the examination section shall be displayed in the concerned department notice boards for the benefit of the students. If any discrepancy found in the displayed Mid marks, it shall be brought to the notice of examination section within two working days from the date of display.

i. Internal marks can be calculated with 80% weightage for better of the two Mids and 20% Weightage for another mid exam.

Example:

Mid-1 marks = Marks secured in (online examination-1+descriptive examination-1 +one assignment-1 + Seminar-1)

Mid-2 marks = Marks secured in (online examination-2+descriptive examination-2 +one assignment-2 + Seminar-2)

Final Internal Marks = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

v. Semester End Examinations Evaluation:

a. The semester end examinations for theory subjects will be conducted autonomous examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

b. For practical subjects shall be conducted for 35 marks by the teacher concerned and external examiner appointed by Chief superintendent/ Controller of Examinations(CoE), VVIT. All the laboratory records and internal test papers shall be preserved in respective departments as per autonomous norms and shall be produced to the Committees as and when they ask for.

c. Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. Students shall pursue this internship during summer vacation just before its offering as per course structure. The minimum duration of this course shall be at least 6 weeks. The student shall register for the internship as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the academic regulations. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner appointed by Chief superintendent/ CoE; Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry

40% and 60% weightages respectively. It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the examination section.

d. The job-oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the on the list skills learned. If the student completes job-oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external (appointed by the Chief superintendent/ CoE) and internal examiner (course instructor or mentor). There are no internal marks for the job-oriented skill courses.

e. Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the department internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.

f. Procedure for Conduct and Evaluation of MOOC: There shall be a Discipline Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL/etc., through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the

same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

g. Major Project (Project - Project work, seminar and internship in industry): In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner. Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the Chief superintendent/ CoE and is evaluated for 140 marks.

vi. Recounting/ Revaluation/ Revaluation by Challenge in the End Semester Examination: A student can request for recounting/ revaluation/ revaluation by challenge of his/her answer book on payment of a prescribed fee as per autonomous norms.

vii. Supplementary Examinations: A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the examination section.

viii. Malpractices in Examinations: Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the academic council.

ix. If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

11. Promotion Rules:

i. A student shall be promoted from first year to second year if he fulfills the minimum attendance requirements.

ii. A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes

the examinations and secures prescribed minimum attendance in II year II semester.

iii. A student shall be promoted from III year to IV year if he fulfills the academicrequirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

12. Course Pattern

i. The entire course of study is for four academic years; all years are on semester pattern.

ii. A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.

iii. When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

13.Grading:

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

% of Marks	Letter Grade	Level	Grade Points
≥ 90	**A+**	Outstanding	10
80 to 89	**A**	Excellent	9
70 to 79	**B**	Very Good	8
60 to 69	**C**	Good	7
50 to 59	**D**	Fair	6
40 to 49	**E**	Satisfactory	5
<40	**F**	Fail	0
ABSENT	**AB**	Absent	0

14. Computation of SGPA and CGPA

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a

student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

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

where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$

where 'S_i' is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the SGPA/CGPA, the subjects in which the student is awarded Zero grade points will also be included.

v. Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

vi. Letter Grade: It is an index of the performance of students in a said course. Grades are denotedby letters A+, A, B, C, D, E and F.

vii. As per AICTE Norms, conversion of CGPA into equivalent percentage as follows:

Equivalent Percentage = (CGPA – 0.50) x 10

viii. Illustration of Computation of SGPA and CGPA

Illustration for SGPA: Let us assume there are 6 subjects in a semester. The grades obtained as follows:

Course	Credit	Grade Obtained	Grade point	Credit x Grade Point
Subject 1	3	B	8	3 X 8 = 24
Subject 2	4	C	7	4 X 7 = 28
Subject 3	3	D	6	3 X 6 = 18
Subject 4	3	A^+	10	3 X 10 = 30
Subject 5	3	E	5	3 X 5 = 15
Subject 6	4	D	6	4 X 6 = 24

	20		139

Thus, SGPA (S_i) =139/20 =6.95=6.9 (approx.)

Illustration for CGPA:

	Sem-1	Sem-2	Sem-3	Sem-4	Sem-5	Sem-6	Sem-7	Sem-8
Credits	20	22	25	26	26	25	21	23
SGPA	6.9	7.8	5.6	6.0	6.3	8.0	6.4	7.5

$$CGPA = \frac{20X6.9 + 22X7.8 + 25X5.6 + 26X6.0 + 26X6.3 + 25X8.0 + 21X6.4 + 23X7.5}{188}$$

$$= \frac{1276.3}{188} = 6.78$$

15. Award of Class:

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

Class Awarded	CGPA to be secured
First Class with distinction*	≥7.75
First Class	≥6.75 &<7.75
Second Class	≥5.75 &<6.75
Pass Class	≥5&<5.75
Fail	<5

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

Thestudents who are approved for break in study for entrepreneurships/startups will also be considered for award of first class with distinction

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

16.Gap - Year:

Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

17. Transitory Regulations

A candidate, who is detained or discontinued a semester, on re-admission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently and the academic regulations be applicable to him/her which are in force at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional courses are to be studied as approved by Board of Studies and ratified by Academic Council.

18. Curricular Framework forHonors Programme

i. Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

ii. A student shall be permitted to register for Honors program at the beginning of 4thsemester provided that the student must have acquired a minimum of 8.0 SGPA up to the end of 2ndsemester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4thsemester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

iii. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completesthe selected advanced courses from samebranch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

iv. In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e., 160 credits).

v. Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.

vi. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

vii. The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

viii. Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.

ix. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.

x. The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

xi. If a student drops or is terminated from the Honorsprogram, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xii. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list

of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

19. Curricular Framework for Minor Programme

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

ii. Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

iii. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE,ME etc., or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science(DS), Robotics, Electric vehicles, Robotics, VLSI etc.

iv. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

v. There shall be no limit on the number of programs offered under Minor. The college can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

vi. The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

vii. A student shall be permitted to register for Minors program at the beginning of 4thsemester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) up to the end of 2nd semester without any history of backlogs. It is expected that the 3rd semesterresults may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA up to 3rdsemester or failed in any of the courses, his registration forMinors program shall stand cancelled. An SGPA of 8 has to be maintained in thesubsequent semesters without any backlog in order to keep the Minors registration active.

viii. A student shall earn additional 20 credits in the specified area to be eligible fortheaward of B. Tech degree with Minor. This is in addition to the credits essential forobtaining the Under Graduate Degree in Major Discipline (i.e., 160 credits).

ix. Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

x. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the University/academic council.

xi. Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

xii. A committee should be formed at the level of College/department toevaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the

departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

xiii. If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a"pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript orNone of the courses done under the dropped Minor will be shown in the transcript.

xiv. In case a student fails to meet the CGPA requirement for B.Techdegree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degreewith Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xv. Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

20. Industrial Collaborations (Case Study)

Institution-Industry linkages refer to the interaction between firms and universities or public research centers with the goal of solving technical problems, working on R&D, innovation projects and gathering scientific as well as technological knowledge. It involves the collaboration of Industries and Universities in various areas that would foster the research ecosystem in the country and enhance growth of economy, industry and society at large.

The Institutions are permitted to design any number of Industry oriented minor tracks as the respective BoS feels necessary. In this process the Institutions can plan to have industrial collaborations in designing the minor tracks and to develop the content and certificate programs. Industry giants such as IBM, TCS, WIPRO etc., may be contacted to develop such collaborations. The Institutions shall also explore the possibilities of collaborations with major industries in the core sectors and professional bodies to create specialized domain skills.

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

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

ACADEMIC REGULATIONS (R20) FOR B. TECH.

(LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2021-22onwards

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

   - A student shall be declared eligible for the award of the B. Tech Degree, if hepursues a course of study in not less than three academic years and not more thansix academic years.
   - The candidate shall register for 121 credits and secure all the 121 credits.
   - A student shall be eligible for the award of B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 121 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

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

3. **Promotion Rule**

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

4. Award of Class

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

Class Awarded	CGPA to be secured
First Class with distinction*	≥7.5
First Class	≥6.5 &<7.5
Second Class	≥5.5 &<6.5
Pass Class	≥4 &<5.5
Fail	<4

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

MALPRACTICE RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No.	Nature of Malpractices/Improper conduct	Punishment
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.

(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the

		candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates	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

	others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, orindulges 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.	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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with

		forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college 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 University for further action to award suitable punishment.	

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

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

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

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

LET US MAKE VVIT A RAGGING FREE CAMPUS

ABSOLUTELY NO TO RAGGING

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

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

STRUCTURE COURSE

Definition of Credit (C)

1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
1 Hour Practical (P) per week	0.5 Credit

Structure of B. Tech program Regulation R20

S.No.	Category	Code	Suggested Breakup of Credits by AICTE	Suggested Breakup of Credits by APSCHE	Breakup of Credits
1	Humanities and Social Sciences including Management courses	HS	12	10.5	**10.5**
2	Basic Science courses	BS	25	21	**21**
3	Engineering Science coursesincluding workshop,drawing, basics of electrical/ mechanical/ computer etc	ES	24	24	**22.5**
4	Professional core courses	PC	48	51	**52.5**
5	Professional Elective courses Relevant to chosenspecialization/ branch	PE	18	15	**15**
6	Open subjects – Electives from other technical and /or emerging subjects	OE	18	12	**12**

7	Project work, seminar and internship in industry or elsewhere	PR	15	16.5	**16.5**
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	NC	Non-Credit	Non-Credit	Non-Credit
9	Skill Oriented Courses	SC	--	10	**10**
Total			**160**	**160**	**160**

I INDUCTION PROGRAM

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. Induction program for students will be offered right at the start of the first year for 3 weeks duration. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

1. **Physical Activity**

   This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga.

   There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

2. **Creative Arts**

   Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

3. **Universal Human Values**

   It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

4. **Literary**

Literary activity would encompass reading, writing and possibly, debating, enacting a play.

5. Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

6. Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

7. Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

8. Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

II SCHEDULE

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

Initial Phase

Day	Activity
Day 0	Student reports to the college and confirms the allotment
Day 1	Academic registration and Orientation program
Day 2	Diagnostic test, Visit to respective departments, Address by College authorities, Interaction with parents, Mentor-mentee groups-Induction within group.

Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

Day-3 onwards

Daily schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. The following is a typical daily timetable.

Session	Activity
I	Physical activity
II	Creative Arts
III	Universal Human Values
IV	Afternoon Session
V	Afternoon Session
VI	Games/Special Lectures
VII	Informal interactions (within group)

Afternoon activities (non-Daily)

The following activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

Session	Activity	Remarks
IV	Familiarization with Department/Branch & Innovation	For 3 days

IV, V, VI	Visits to Local Area	For 3 days
IV	Lectures by Eminent People	3-5 lectures
IV	Literary (Play/Book/Reading/Lecture)	3-5 days
V	Proficiency Modules	Daily for specific students

Closing Phase

The following activities are schedule in closing phase.

Day	Activity
Last but one day	Discussions and finalization of presentation within each group
Last day	Examinations (if any)

SEMESTER-WISE STRUCTURE OF CURRICULUM

Course structure for eight semesters during four years of study is as follows

I Year I Semester (Semester-1)

S.NO	Course Code	Course Name	L	T	P	C
1	20HS1101	Communicative English	3	0	0	3
2	20BS1101	Mathematics-I	3	0	0	3
3	20BS1105	Applied Physics	3	0	0	3
4	20ES1101	Problem Solving using C	3	0	0	3
5	20ES1102	Engineering Graphics	1	0	4	3
6	20HS1102L	Communicative English Lab	0	0	3	1.5
7	20BS1106L	Applied Physics and Virtual Lab	0	0	3	1.5
8	20ES1103L	Problem Solving using C Lab	0	0	3	1.5
Total Credits						**19.5**

Category		Credits
BS	Basic Science Courses	3+3+1.5=7.5
ES	Engineering Science Courses	3+3+1.5=7.5
HS	Humanities and Social Sciences including Management courses	3+1.5=4.5
Total Credits		19.5

I Year II Semester (Semester-2)

S.No.	Course Code	Course Name	L	T	P	C
1	20BS1202	Mathematics-II	3	0	0	3
2	20ES1204	Basic Electrical Engineering	3	0	0	3
3	20BS1209	Applied Chemistry	3	0	0	3
4	20ES1205	Network Analysis	2	1	0	3
5	20ES1206	Problem Solving using Python	3	0	0	3
6	20ES1207L	Basic Electrical Engineering Lab	0	0	3	1.5
7	20BS1210L	Applied Chemistry Lab	0	0	3	1.5

8	20ES1208L	Problem Solving using Python Lab	0	0	3	1.5
9	20MC1201	Indian Constitution	2	0	0	0
Total Credits						**19.5**

Category		Credits
BS	Basic Science Courses	3+3+1.5=7.5
ES	Engineering Science Courses	3+3+3+1.5+1.5=12
MC	Mandatory Course (AICTE)	0
Total Credits		19.5

II Year I Semester (Semester-3)

S.No.	Course Code	Course Name	L	T	P	C
1	20BS2112	Mathematics-III	2	1	0	3
2	20PC2101	Electronic Devices & Circuits	3	0	0	3
3	20PC2102	Signals and Systems	2	1	0	3
4	20PC2103	Digital Circuits and Logic Design	3	0	0	3
5	20BS2113	Random Variables and Stochastic Processes	3	0	0	3
6	20PC2104L	Electronic Devices and Circuits Lab	0	0	3	1.5
7	20PC2105L	Signals and Systems Lab	0	0	3	1.5
8	20PC2106L	Digital Circuits and Logic Design Lab	0	0	3	1.5
9	20SC2101	Skill Oriented Course - 1	1	0	2	2
10	20MC2102	Essence of Indian Traditional Knowledge	2	0	0	0
Total Credits						**21.5**

Category		Credits
BS	Basic Science Courses	3+3=6
PC	Professional Core courses	3+3+3+1.5+1.5+1.5 =13.5
SC	Skill Oriented Course	2
MC	Mandatory Course (AICTE)	0
	Total Credits	**21.5**

II Year II Semester (Semester-4)

S.No.	Course Code	Course Name	L	T	P	C
1	20PC2207	Analog Circuits	3	0	0	3
2	20PC2208	Electromagnetic Fields and Waves	2	1	0	3
3	20PC2209	Digital System Design with VHDL	3	0	0	3
4	20ES2209	Control Systems	3	0	0	3
5	20OE2201	Open Elective - 1	3	0	0	3
6	20PC2211L	Analog Circuits Lab	0	0	3	1.5
7	20PC2202L	Digital System Design with VHDL Lab	0	0	3	1.5
8	20SC2202	Skill Oriented Course - 2	1	0	2	2
Total Credits						**20**
		Internship/Community Service Project/NCC 2 Months (Mandatory) during summer vacation				
		Honors/Minor courses	3	1	0	4

Category		Credits
ES	Engineering Science Courses	3
PC	Professional Core courses	3+3+3+1.5+1.5=

		12
OE	Open Elective Courses/Job Oriented Elective Courses	3
SC	Skill Oriented Course	2
Total Credits		**20**

III Year I Semester (Semester-5)

S.No.	Course Code	Course Name	L	T	P	C
1	20PC3112	Linear IC Applications	3	0	0	3
2	20HS3104	Engineering Economics and Management	3	0	0	3
3	20PC3113	Analog and Digital Communications	3	0	0	3
4	20PC3114	VLSI Design	3	0	0	3
5	20OE3102	Open Elective – 2	3	0	0	3
6	20PC3115L	Linear IC Applications Lab	0	0	3	1.5
7	20PC3116L	VLSI Design Lab	0	0	3	1.5
8	20PC3117L	Analog and Digital Communications Lab	0	0	3	1.5
9	20SC3103	Skill Advanced Course – 1 (Soft Skills)	1	0	2	2
10	20PR3101	Summer Internship 2 Months (Mandatory) after Second Year (to be evaluated during V semester)	0	0	3	1.5
11	20MC3103	Environmental Science	2	0	0	0
Total Credits						**23**
		Honors/Minor courses	3	1	0	4

Category		Credits
HS	Humanities and Social Science Courses	3
PC	Professional Core Courses	3+3+3+1.5+1.5+1.5

		=13.5
OE	Open Elective Courses/Job Oriented Elective Courses	3
SC	Skill Advanced Course/Soft Skills Course	2
PR	Summer Internship	1.5
MC	Mandatory Course (AICTE)	0
Total Credits		**23**

III Year II Semester (Semester-6)

S.No.	Course Code	Course Name		L	T	P	C
1	20PC3218	Digital Signal Processing		3	0	0	3
2	20PC3219	Microprocessors and Microcontrollers		3	0	0	3
3	20PC3220	Microwave Engineering and Optical Communication		3	0	0	3
4	20PE3201	Professional Elective – 1	Antennas and Wave Propagation Information Theory and Coding Speech Fundamentals Analog IC Design	3	0	0	3
5	20PC3221L	Microprocessors and Microcontrollers Lab		0	0	3	1.5
6	20PC3222L	Microwave Engineering and Optical Communication Lab		0	0	3	1.5
7	20PC3223L	Digital Signal Processing Lab		0	0	3	1.5
8	20SC3204	Skill Advanced Course – 2		1	0	2	2
9	20HS3205	Universal Human Values – 2		3	0	0	3
10	20MC3204	Entrepreneurial Skill Development		2	0	0	0
Total Credits							**21.5**
		Industrial/Research Internship 2 Months (Mandatory) during summer					

		vacation				
		Honors/Minor courses	3	0	2	4

Category		Credits
HS	Humanities and Social Science Courses	3
PC	Professional Core Courses	3+3+3+1.5+1.5+1.5= 13.5
PE	Professional Elective Courses	3
SC	Skill Advanced Course/Soft Skills Course	2
MC	Mandatory Course (AICTE)	0
Total Credits		**21.5**

IV Year I Semester (Semester-7)

S.No.	Course Code	Course Name		L	T	P	C
1	20PE4102	Professional Elective – 2	Advanced Computer Architecture Radar Engineering Speech Processing Digital IC Design	3	0	0	3
2	20PE4103	Professional Elective – 3	Fundamentals of Nanotechnology Satellite Communications NPTEL/SWAYAM MOOCS Introduction to MEMS & NEMS	3	0	0	3
3	20PE4104	Professional Elective – 4	Digital Image Processing Wireless Sensor Networks Speech Enhancement RF Integrated Circuits	3	0	0	3
4	20PE4105	Professional Elective – 5	Computer Networks Mobile Cellular Communication Advanced DSP Low Power VLSI Design	3	0	0	3
5	20OE4103	Open Elective – 3		3	0	0	3
6	20OE4104	Open Elective – 4		3	0	0	3
7	20SC4105	Skill Advanced Course – 3		1	0	2	2
8	20PR4102	Industrial / Research Internship 2 Months (Mandatory) after Third Year (to be		0	0	6	3

		evaluated during VII semester)				
Total Credits						**23**
		Honors/Minor courses	3	0	2	4

Category		**Credits**
PE	Professional Elective Courses	3+3+3+3=12
OE	Open Elective Courses/Job Oriented Elective Courses	3+3=6
SC	Skill Advanced Course/Soft Skills Course	2
PR	Summer Internship	3
Total Credits		**23**

IV Year II Semester (Semester-8)

S. No	**Subject code**	**Course Name**	**L**	**T**	**P**	**C**
1	20PR4203	Major Project Project work, seminar, and internship in industry	0	0	0	12
		Internship (6 months)				
Total Credits						**12**

*CSP (Community Service Project) is evaluated in the Final Year and 4 credits will be awarded by splitting the credits from the IV Year – II Semester major project as per the proceedings No. JNTUK/DAP/CSP/Distribution of Credits/2022 dated on 24-09-2022.

Skill oriented course/Skill advanced courses

Subject Code	Track-1 (Core)	Track-2 (Programming)	Track-3 (Cloud Technologies)
20SC2101	SCILAB	Data Pre-Processing and Visualization using Python	AWS
20SC2202	Open source hardwaretools for Electronics Engineers	Machine Learningusing Scikit-Learn	NoSQL
20SC3103	Soft Skills	Soft Skills	Soft Skills
20SC3204	Social IoT	Web Development (HTML/CSS/PHP)	Android Application Development
20SC4105	Networking(CCNA)	Deep Learning with Tensor Flow	IoT Tools and Applications

Open Elective Courses

Open Elective- I	Open Elective- II	Open Elective- III	Open Elective- IV
Data Structures	OOPS Through Java	Machine Learning	Operating Systems
Mechatronics	Embedded C	Industrial and Medical Internet of Things	Computer Vision
MATLAB for Engineering Applications	Total Quality Management	Marketing Management	Advanced Control Systems
DBMS	Disaster Management	Advanced Java	Green Buildings

Courses for Honors degree

Pool-I (Advanced Communications)	Pool-II (IoT & Blockchain)	Pool-III (Advanced VLSI)	Pool-IV (Deep Learning)
5G Communications	Next Generation IoT Networks	RFID and Microcontrollers	Natural Language Processing
Principles of Signal Estimation for MIMO/OFDM Wireless Communication	Internet of Robotics	Nano Technology	Neural Networks and Deep Learning
Modern Digital Communication Techniques	Blockchain Fundamentals and Use Cases	Mixed Signal Design	Convolutional Neural Networks
Multimedia Communication	Blockchain Application Development	Advanced IC Design	Time Series Analysis
MOOC-1*(NPTEL/SWAYAM)Duration: 08 Weeks minimum			
MOOC-2*(NPTEL/SWAYAM)Duration: 08 Weeks minimum			

*Course/subject title can't be repeated

Note:

1. Students has to acquire 16 credits with minimum one subject from each pool
2. Compulsory MOOC/NPTEL course for 4 credits (2 course, each 2 credited)

General Minor Tracks
Department of Electronics and Communication Engineering

S.No.	Course Name	L	T	P	C
1	Principles of Communication Systems	3	0	2	4
2	Analog and Digital Signal Processing	3	0	2	4
3	Very Large Scale Integrated Circuits	3	0	2	4
4	Embedded Systems	3	0	2	4
5	Advanced Communications	3	0	2	4
6	VLSI Architectures for IoT Networks	3	0	2	4

Note:

1. A student can select four subjects from the above six subjects @3-0-2-4credits per subject.
2. Compulsory MOOC/NPTEL courses for 04 credits (02 courses @ 02 credits each)

VVIT Life skill courses

The following courses are admitted to be the **courses beyond curriculum** to improve individual life skills. These courses and will be demonstrated in the class room and will be having an internal assessment for satisfactory.

S. No	Year and Semester	Course Name
1	I Year I Semester (Semester-1)	Quantitative Aptitude
2	I Year II Semester (Semester-2)	Verbal Ability

3	II Year I Semester (Semester-3)	Understanding Self for Effectiveness
4	II Year II Semester (Semester-4)	Design Thinking
5	III Year I Semester (Semester-5)	Stress and Coping Strategies
6	III Year II Semester (Semester-6)	Research Skills

SYLLABUS

I-Year

I- Semester COMMUNICATIVE ENGLISH

L	T	P	C
3	0	0	3

Course Objectives:

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

UNIT-I: 13 HOURS

Detailed Study: A Proposal to Girdle the Earth (Excerpt) by Nellie Bly Theme: Exploration

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

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

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

Grammar and Vocabulary: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable;

singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Non-Detailed Study:

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

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

UNIT-II:13 HOURS

Detailed Study: An excerpt from The District School as It Was by One Who Went to It by Warren Burton

Theme: On Campus

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

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

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

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

Grammar and Vocabulary: Cohesive devices - linkers, signposts and transition signals; use ofarticles and zero article; prepositions.

Non-detailed Study:

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

4. "How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz

UNIT-III: 13 HOURS

Detailed Study: The Future of Work? Theme: Working Together

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

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

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

Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoidingredundancies and repetitions.

Grammar and Vocabulary: Verbs - tenses; subject-verb agreement; direct and indirect speech,reporting verbs for academic purposes.

Non-Detailed Study:

5. "How to Make the Most of Your Abilities" by Kenneth Hildebrand

6. "How to Raise Your Self-Esteem and Develop Self-confidence" by James W Newman

UNIT-IV:13 HOURS

Detailed Study: H.G Wells and the Uncertainties of Progress by Peter J. Bowler

Theme: Fabric of Change

Listening: Making predictions while listening to conversations/ transactional dialogues withoutvideo; listening with video.

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

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

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

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

Non-Detailed Study

7. "How to Win Your War against Negative Feelings" by Dr Maxwell Maltz

8. "How to Find the Courage to Take Risks" by Drs. Tom Rusk and Randy Read

UNIT-V: 13 HOURS

Detailed Study: Leaves from the Mental Portfolio of a Eurasian by Sui Sin Far Theme: Tools for Life

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

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

Reading: Reading for comprehension.

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

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

Non-Detailed Study

9. "How to Become a Self-Motivator" by Charles T Jones

10. "How to Eliminate Your Bad Habits" by OgMandino

Text Books

1. English All Round: Communication Skills for Undergraduate Learners- Volume 1, OrientBlack Swan, 2019
2. University of Success by OgMandino, Jaico, 2015.

Reference Books

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

AICTE Recommended Books

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

E Resources

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

BBC Learning English – Pronunciation tips Merriam-
Webster – Perfect pronunciation ExercisesAll Skills
https://www.englishclub.com/
http://www.world-english.org/
http://learnenglish.britishcouncil.org/

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

CO1	Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and formulate sentences using proper grammatical structures and correct word forms **(Describe, relate, tell, find L-3)**
CO2	Speak clearly on a specific topic using suitable discourse markers in informal discussions **(Discuss, outline, explain, predict – L3)**
CO3	Write summaries based on global comprehension of reading/listening texts **(Use,** **categorize, complete, solve L-3)**
CO4	Produce a coherent paragraph interpreting a figure/graph/chart/table **(Identify, compare,** **explain, illustrate- L4)**
CO5	Take notes while listening to a talk/lecture to answer questions **(explain, relate, outline,** **complete -L3)**

I-Year-I Semester
BS1101

L	T	P	C
3	0	0	3

Mathematics-I

Preamble: This course illuminates the students in the concepts of calculus.

Course Objectives:

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

UNIT-I:13 HOURS

Differential equations of first order and first degree

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

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

UNIT-II:13 HOURS

Linear differential equations of higher order

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous

term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x^n, $e^{ax}V(x)$ and $x^nV(x)$ - Method ofVariation of Parameters.

Applications: LCR circuit – Simple harmonic motion

UNIT-III:12 HOURS

Mean value theorems

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

UNIT-IV:14 HOURS

Partial differentiation

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

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

UNIT-V:13 HOURS

Multiple integrals

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

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

Text Books

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

Reference Books

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

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

CO1	Solve the differential equations related to various engineering fields.
CO2	Utilize mean value theorems to real life problems.
CO3	Familiarize with functions of several variables which is useful in optimization.
CO4	Apply double integration techniques in evaluating areas bounded by region.

CO5	Learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3 – dimensional coordinate systems.

I-Year-I Semester

BS1105

APPLIED PHYSICS

L	T	P	C
3	0	0	3

Course Objectives:

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

1. Impart Knowledge of Physical Optics phenomena like Interference and Diffractionrequired to design instruments with higher resolution.
2. Understand the physics of Semiconductors and their working mechanism for their utility inelectronic devices.
3. Impart the knowledge of materials with characteristic utility in appliances.

UNIT-I: WAVE OPTICS 13 HOURS

Interference: Principle of Superposition-Interference of light –Conditions for sustained Interference-Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry)

Diffraction: Fraunhofer Diffraction:- Diffraction due to single slit (quantitative), double slit(qualitative), N –slits(qualitative) and circular aperture (qualitative) – Intensity distribution curves - Diffraction grating – Grating spectrum – missing order– resolving power – Rayleigh's criterion – Resolving powers of Microscope(qualitative), Telescope(qualitative) and grating (qualitative).

UNIT– II: LASERS AND HOLOGRAPHY 13 HOURS

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

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

UNIT-III: MAGNETISM AND DILECTRICS 13 HOURS

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

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

UNIT-IV: QUANTUM MECHANICS 15 HOURS

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

UNIT-V: SEMICONDUCTOR PHYSICS11 HOURS

Origin of energy bands(qualitative) –Classification of solids based on energy bands – Intrinsic semiconductors-density of charge carriers –Electrical conductivity-Fermi level –extrinsic semiconductors-P-type &N-type–density of charge carriers dependence of Fermi energy on carrier concentration and temperature-Hall effect-Hall coefficient-Applications of Hall effect- Drift and Diffusion currents - Einstein's equation

Text Books

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

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

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

CO1	**Understand** the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments.
CO2	**Learn** the basic concepts of LASER light Sources and Apply them to holography
CO3	**Study** the magnetic and dielectric materials to enhance the utility aspects of materials.
CO4	**Learn** the fundamental concepts of Quantum behavior of matter.
CO5	**Identify** the type of semiconductors using Hall Effect.

I-Year-I Semester

ES1101

L	T	P	C
3	0	0	3

PROBLEM SOLVING USING C

Course Objectives:

1. To learn about the computer systems, computing environments, developing of a computerprogram and Structure of a C Program
2. To gain knowledge of the operators, selection, control statements and repetition in C
3. To learn about the design concepts of arrays, strings, enumerated structure and union types.To learn about their usage.
4. To assimilate about pointers, dynamic memory allocation and know the significance of Pre-processor.
5. To assimilate about File I/O and significance of functions

UNIT-I:13 HOURS

Introduction to Computers: Creating and running Programs, Computer Numbering System,Storing Integers, Storing Real Numbers

Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers. **Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line

Arguments.

UNIT-II:13 HOURS

Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators. **Selection & Making Decisions:** Logical Data and Operators, Two Way Selection, MultiwaySelection, More Standard Functions.

Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping

Applications, Programming Examples.

UNIT-III:12 HOURS

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays,Multidimensional Arrays, Programming Example – Calculate Averages.

Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code.

Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types,

Structure, Unions, and Programming Application.

UNIT – IV:14 HOURS

Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value

Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, MemoryAllocation Function, Array of Pointers, Programming Application.

Processor Commands: Processor Commands.

UNIT-V:13 HOURS

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions

Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files,Converting File Type.

Text Books

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE
2. The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson

Reference Books

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD

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

CO1	**Understand** algorithms and basic terminology of C
CO2	**Solve** problems using control structures and modular approach
CO3	**Demonstrate** 1D and 2D arrays along with strings for linear data handling
CO4	**Determine** the use of pointers and structures
CO5	**Implement** various operations on data files.

I- Year-I Semester **ENGINEERING GRAPHICS**

ES1102

L	T	P	C
1	0	4	3

Course Objectives:

1. Expose the students to use Drafting packages for generating Engineering curves andconventions followed in Preparation of engineering drawings.
2. Make the students to understand the concepts of orthographic projections of Lines andPlane Surfaces.
3. To understand the concepts of orthographic projections of Regular Solids.
4. Develop the ability of understanding sectional views and Development of Solid Surfaces.
5. Enable them to use computer aided drafting packages for Conversion of Isometric view toOrthographic Projection and vice versa.

UNIT-I: INTRODUCTION TO AUTOCAD: 15 HOURS

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

Core Branch Applications).

UNIT-II: THEORY OF PROJECTION: 12 HOURS

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

UNIT III: PROJECTIONS OF REGULAR SOLIDS: 12 HOURS

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

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

UNIT IV: DEVELOPMENT OF SURFACES & SECTIONAL ORTHOGRAPHIC VIEWS 13 HOURS

Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and, Cone. Draw

the sectional orthographic views of geometrical solids.

UNIT V: ISOMETRIC PROJECTIONS 13 HOURS

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

Text Books

1. Engineering Drawing by N.D. Butt, Chariot Publications

2. Engineering Graphics with Autocad by Kulkarni D.M , PHI Publishers

3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

4. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

Reference Books

1. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers

2. Engineering Graphics for Degree by K.C. John, PHI Publishers

3. Engineering Graphics by PI Varghese, McGrawHill Publishers

4. AutoCAD 2018 Training Guide (English, Paperback, Sagar Linkan) ISBN: 9789386551870,938655187X RUPAPUBLICATIONS

E-Resources:

1 .https://www.autodesk.com.au/campaigns/autocad-tutorials

2. https://nptel.ac.in/courses/112104172

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

CO1	Prepare engineering drawings as per BIS conventions.
CO2	Produce computer generated of orthographic projections of Lines and Plane surfaces using CAD software.

CO3	Use the knowledge of orthographic projections of Solids to represent engineering information/concepts and present the same in the form of drawings.
CO4	Use the knowledge of sectional views and Development of Solid Surfaces in Real time Applications.
CO5	Develop isometric drawings of simple objects reading the orthographic projections of those objects.

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I-Year-I Semester HS1102L	COMMUNICATIVE ENGLISH LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

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

The specific objectives of the course are to

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

Detailed Syllabus

Introduction to Sound system of English

Articulation - Airstream mechanism, Manners of Articulation, Places of Articulation, Englishphonetic symbols.

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

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

I. **A. Speaking**: Introducing Yourself and Others
B. Listening: Conversation between two and more people.

II. **A. Speaking:** Speak for a minute in response to a question about personal experience /wish.
B. Listening: Identifying the main idea of a talk or a conversation

III. **A. Speaking: Group discussion** – 5 minutes followed by a summary –1 or 2 minutes: Topics-1. Features that make a place beautiful, 2. The most challenging job you can think of, 3. Some skills that everyone should learn, 4. The best criteria to measure success, 5. A recent news story that is interesting, 6. Impact of technology on the music industry, 7. An app that has helped society, 8. Pros and Cons of after school tutorials, 9. How to stay safe on Social Media, 10. The most common reasons why friendships fall apart, 11. Interactions with seniors on campus, 12. Coping with peer pressure, 13. Others' opinion vs your belief, 14. Feeling that plants would express if they could, 15. Growing up alone vs Growing up with siblings, 16. Uniforms stifle individuality, 17. In India summer is the best and worst of times, 18. A good sense of humour is a definite perk, 19. All fast food is not junk food and 20. Ideas to make your common room in college more inviting. Question Answer sessions – 1. Idea of a Tech Startup, 2. Training programme of T&P Cell, 3. Inter-college Cultural Fest, 4. 3-day Foreign University delegation visit to the campus, 5. Computer training programme by a reputed MNC, 6. Shifting your Dept or Classrooms to new location on campus, 7. How to manage attendance while attending additional courses (Minors/Honors), 8. How to choose placement offers? 9. Involvement in Student Affairs through SAC, 10. Planning an excursion.
B. Listening: 1. Comprehension Exercise on Teamwork, 2. Predicting what the speaker would say from the title of the talk, 3. Comprehension based on a narrative or a short video, TED Talks

IV. **A. Speaking:** Preparing speech using picture clues, asking Q&A using

pictures.

B. Listening: Listening Comprehension using short films, audio files, interviews of famous personalities

V. **A. Speaking:** Preparing 30-day planner using important phrasal expressions in speech, Oral Presentations on – 1. Setting goals is important2. Asking the right question is the skill you need to develop, 3. Do college students want their parents' attention 4. Everyone needs to learn how to cook5. Doing household chores is everyone's responsibility 6. Study groups facilitate peer-monitoring7. Is it OK for students to do things just because they want to fit in? 8. Students should compulsorily make time for physical activity, 9. Taking breaks to pursue other interests improves academic performance, 10. Strategies to avoid stress, 11. How best to use the media for educational activities, 12. Why volunteer for service activities? 13. International student exchange programme, 15. Work-life balance 16. Strategies to build on your strength and overcome weaknesses, 17. Strategies to build confidence and self-esteem18. Procrastination kills opportunities, 19. Setting a budget and sticking to it, 20. Grooming and etiquette 21. Pros and Cons of being Competitive, 22. Virtual classroom vs real classroom, 23. Freedom brings more responsibility 24. To-do lists help you become more productive 25. Having a diverse group of friends is an asset 26. One thing you wish you had learnt in High school 27. Why is it important to be non-judgmental towards others? 28. Humans need empathy, 29. Public speaking is a necessary skill 30. How to build and maintain good professional relationships.

B. Listening: Listening Comprehension, Speeches by Famous personalities

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

1. "How to Fashion Your Own Brand of Success" by Howard Whitman
2. "How to Recognize Your Failure Symptoms" by Dorothea Brande
3. "How to Conquer the Ten Most Common Causes of Failure" by Louis Binstock
4. "How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz
5. "How to Make the Most of Your Abilities" by Kenneth Hildebrand
6. "How to Raise Your Self-Esteem and Develop Self-Confidence" by James W.

Newman

7. "How to Win Your War against Negative Feelings" by Dr Maxwell Maltz
8. "How to Find the Courage to Take Risks" by Drs. Tom Rust and Randy Reed
9. "How to Become a Self-Motivator" by Charles T Jones
10. "How to Eliminate Your Bad Habits" by Og Mandino

Text Books

1. English All Round: Communication Skills for Undergraduate Learners- Volume 1, OrientBlack Swan, 2019
2. University of Success by OgMandino, Jaico, 2015.

Reference Books

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

AICTE Recommended Books

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

E-Resources

Grammar / Listening / Writing

1. 1-language.com
2. http://www.5minuteenglish.com/
3. https://www.englishpractice.com/

Grammar/Vocabulary

4. English Language Learning Online

5. http://www.bbc.co.uk/learningenglish/
6. http://www.better-english.com/
7. http://www.nonstopenglish.com/
8. https://www.vocabulary.com/
9. BBC Vocabulary Games
10. Free Rice Vocabulary Game

Reading

11. https://www.usingenglish.com/comprehension/
12. https://www.englishclub.com/reading/short-stories.htm
13. https://www.english-online.at/

Listening

14. https://learningenglish.voanews.com/z/3613
15. http://www.englishmedialab.com/listening.html

Speaking

16. https://www.talkenglish.com/
17. BBC Learning English – Pronunciation tips
18. Merriam-Webster – Perfect pronunciation Exercises

All Skills

19. https://www.englishclub.com/
20. http://www.world-english.org/
21. http://learnenglish.britishcouncil.org/

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

CO1	Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and speak clearly on a specific topic using suitable discourse markers in informal discussions. (L3)
CO2	Take notes while listening to a talk/lecture; to answer questions in English; formulatesentences using proper grammatical structures and correct word forms; and use language effectively in competitive examinations. (L3)
CO3	Write summaries based on global comprehension of reading/listening texts; produce a coherent write-up interpreting a figure/graph/chart/table; and use English as a successfulmedium of communication. (L3)

I-Year-I Semester BS1106L	APPLIED PHYSICS AND VIRTUAL LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

The Applied Physics Lab is designed to:

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

LIST OF EXPERIMENTS (Any 10 of the following listed 15 experiments):

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

13. Rigidity modulus of material by wire-dynamic method (torsional pendulum)

14. Dispersive power of diffraction grating.

15. Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall Effect.

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

CO1	**Operate** optical instruments like microscope and spectrometer
CO2	**Determine** thickness of a paper with the concept of interference
CO3	**Estimate** the wavelength of different colors using diffraction grating and resolving power
CO4	**Plot** the intensity of the magnetic field of circular coil carrying current with distance
CO5	**Calculate** the band gap of a given semiconductor

I-Year-I Semester ES1103L	**PROBLEM SOLVING USING C LAB**	L	T	P	C
		0	0	3	1.5

Course Objectives:

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

Exercise 1

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.

2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.

3. Write a C program to display multiple variables.

Exercise 2

1. Write a C program to calculate the distance between the two points.

2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.

3. Write a C program to calculate the factorial of a given number.

Exercise 4

1 .Write a program in C to display the n terms of even natural number

and their sum.

2. Write a program in C to display the n terms of harmonic series and their sum.1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

Exercise 9

1. Write a C Program to Store Information Using Structures with Dynamically MemoryAllocation

2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10

1. Write a program in C to demonstrate the use of & (address of) and *(value at address)operator.

2. Write a program in C to add two numbers using pointers.

Exercise 11

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program,allocate memory dynamically using malloc( ) function.

Exercise 14

1. Write a C program to find sum of n elements entered by user. To perform this program,allocate memory dynamically using calloc( ) function. Understand & write the difference.

2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15

1. Write a program in C to check whether a number is a prime number or not using the function.

2. Write a program in C to get the largest element of an array using the function.

Exercise 16

1. Write a program in C to append multiple lines at the end of a text file.

2. Write a program in C to copy a file in another name.

3. Write a program in C to remove a file from the disk.

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

CO1	**Comprehend** the various concepts of a C language
CO2	**Develop** algorithms and flowcharts
CO3	**Design** and development of C problem solving skills
CO4	**Acquire** modular programming skills
CO5	**Access** different files using C programming

I- Year-II Semester
BS1202

MATHEMATICS-II

L	T	P	C
3	0	0	3

Course Objectives:

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

UNIT-I: ITERATIVE METHOD 11 HOURS

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

UNIT-II: INTERPOLATION 14 HOURS

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

difference formula.

UNIT-III: NUMERICAL INTEGRATION AND SOLUTION OF ORDINARY DIFFERENCE EQUATIONS 12 HOURS

Trapezoidal rule–Simpson's $1/3^{rd}$ and $3/8^{th}$ rule–Solution of ordinary differential equations by Taylor's series–Picard's method of successive approximations–Euler's method–Modified Euler's

method–Runge-Kutta method (second and fourth order).

UNIT–IV: LAPLACE TRANSFORMS 14 HOURS

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

Applications: Evaluation of integrals using Laplace transforms - Solving ordinary differential

equations (Initial value problems) using Laplace transforms.

UNIT-V: FOURIER SERIES AND FOURIER TRANSFORMS 14 HOURS

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

Fourier Transforms: Fourier integral theorem (without proof) - Fourier sine and cosine integrals –

Sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

Text Books

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

Reference Books

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

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

CO1	Evaluate approximate in the roots of polynomial and transcendental equations by different algorithms (EVALUATE)
CO2	Solve system of linear algebraic equations using Gauss Jacobi, Gauss Seidel and apply Newton's forward and backward interpolation and Lagrange's formulae for equal and unequal intervals(SOLVE, APPLY, FIND)
CO3	Apply different algorithms for approximating the solutions of ordinary differential equations to itsanalytical computations and also by Laplace the transforms for solving differential equations (SOLVE, APPLY, FIND)

CO4	Find or compute the Fourier series of periodic signals (SOLVE, APPLY, FIND, ANALYSE)
CO5	Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms (SOLVE, APPLY, FIND)

I-Year-II Semester ES1204	BASIC ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the principle of operation, constructional details and operational characteristics of DC generator and DC Motor.
2. To learn the constructional details, principle of operation and performance of transformers.
3. To study the principle of operation, construction and details of synchronous machines.
4. To learn the principle of operation, constructional details, performance, torque – slip characteristics of 3-phase induction motors.
5. To understand the principle of operation, constructional details and operational of Single-Phase Induction Motor.

UNIT-I: DC MACHINES 13 HOURS

Principle of operation of DC generator – EMF equation – types of DC machines – Principle operation of DC Motor-torque equation of DC motor – applications - losses and efficiency - Swinburne's test - speed control methods – OCC of DC generator- Brake test on DC Shunt

motor-numerical problems.

UNIT-II: TRANSFORMERS 13 HOURS

Transformers Principle of operation of single- phase transformer constructional features – EMF equation – Losses and efficiency of transformer- regulation of transformer – OC & SC testspredetermination of efficiency and regulations –Numerical Problems.

UNIT-III: 14 HOURS

Synchronous Generators

Principle of operation and construction of alternators – types of alternators- EMF equation of three phase alternator- Regulation of alternator by synchronous impedance method.

Synchronous Motors

Constructions of three phase synchronous motor - operating principle.

UNIT-IV: INDUCTION MACHINES 13 HOURS

Principle of operation and construction of three-phase induction motors – slip ring and squirrel cage motors – slip-torque characteristics – efficiency calculation – starting methods-Brake test on

3-Phase Induction Motor.

UNIT-V: SPECIAL MACHINES 12 HOURS

Principle of operation and construction - single phase induction motor– capacitor Start motor- Capacitor start and Capacitor run Motor-Permanent Capacitor Motor- shaded pole motors.

Text Books

1. Principles of Electrical Machines by V.K. Mehta & Rohit Mehta, S.Chand publications.
2. Theory & performance of Electrical Machines by J.B.Guptha, S.K.Kataria &Sons.

Reference Books

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications.
2. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition.
3. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.

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

CO1	Understand the concepts of DC Machine and principle operation of DC Generator and DC Motor.
CO2	Quantify the performance of single-phase transformers.
CO3	Analyze the operation of synchronous machines and determination of voltage regulation
CO4	Analyze the performance and speed – torque characteristics of a 3- phase induction motor and understand starting methods of 3-phase induction motor.
CO5	Empathies operation of various single phase induction Motors.

I-Year-II Semester BS1200	APPLIED CHEMISTRY	L	T	P	C
		3	0	0	3

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

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

UNIT-I: POLYMER TECHNOLOGY 14 HOURS

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

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

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

Composite Materials: Fiber reinforced plastics-CFRP and GFRP

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

Bio degradable polymers: Biopolymers and biomedical polymers.

UNIT-II: ELECTROCHEMICAL CELLS AND CORROSION 12 HOURS

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

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

(nickel), paints (constituents and its functions).

UNIT-III: MATERIAL CHEMISTRY 12 HOURS

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

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

Liquid crystals: Introduction-types-applications.

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

UNIT–IV: ADVANCED CONCEPTS AND GREEEN CHEMISTRY 10 HOURS

Molecular switches and machines: Introduction to supramolecular chemistry, characteristics of molecular motors and machines. Rotaxanes and Catenanes as artificial molecular machines. Protypes linear motions in Rotaxanes, and acid-base controlled molecular shuttle, a molecular elevator, an autonomous light –powered molecular motors, natural molecular motors and machine.

Green chemistry: Principles of green chemistry, green synthesis – aqueous phase, microwave

assisted chemical reactions and phase transfer catalysis (PTC).

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

Spectroscopic Techniques: Electromagnetic spectrum-types of molecular spectra and theirabsorption criteria.

UV-visible spectroscopy (electronic spectroscopy), Frank-Condon principle, Beer-Lambert's law and its limitations, chromophores and auxochromes – *applications of UV visible spectroscopy. ***IR*** spectroscopy – functional group and finger print region – molecular vibrations – stretching and bending vibrations – *applications of IR.

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

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

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

cycle OTEC.

Text Books:

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

Reference Books:

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

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

CO1	**Explain** the preparation, properties and applications of thermoplastics, thermosettings, elastomers and conducting polymers.
CO2	**Know** the importance of various materials and their uses in the construction of batteries and fuel cells.
CO3	**Know** the applications of advanced materials in various industries.
CO4	**Apply** the principles of supramolecular chemistry in the applications of molecular machines, need of green chemistry.
CO5	**Explain** the principles of spectrometry such as UV, IR, and NMR.

I-Year-II Semester ES1205	NETWORK ANALYSIS	L	T	P	C
		2	1	0	3

Pre-Requisites: Matrices

Course Objectives:

1. To provide a methodical approach to problem solving
2. To learn a number of powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methods of simplifying networks
3. Different types of two-port network analysis using network parameters, with different types of connections.
4. To develop a clear understanding of the important parameters of a magnetic circuits.
5. To understand the basic concepts on RLC circuits under steady and transient states using time domain techniques.

UNIT-I: DC CIRCUITS- BASIC LAWS AND METHODS OF ANALYSIS 18 HOURS

Basic Laws: Introduction to circuit elements, Ohm's Law ,Nodes, Branches, and Loops, Kirchhoff's Laws for DC circuits, Power Relations, Independent and dependent sources, ideal and practical sources, source transformation, Series Resistors and Voltage Division, Parallel Resistors and Current Division, Wye-Delta Transformations.

Methods of Analysis: Mesh Analysis, Mesh analysis with current sources, Nodal analysis and Nodal analysis with voltage sources.

Applications: Lighting Systems and Electricity Bills

UNIT-II: SINUSOIDAL STEADY STATE ANALYSIS OF AC CIRCUITS 11 HOURS

Review AC fundamentals, Phasor representation of sinusoidal waves, Phasor Relationships for Circuit Elements, Impedance and Admittance, Nodal Analysis, Mesh analysis, AC power analysis.

Applications: Power Measurement, Electricity Consumption Cost Bills.

UNIT-III: CIRCUIT THEOREMS 15 HOURS

Circuit Theorems for DC Circuits: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, and Reciprocity Theorem.

Circuit Theorems for AC Circuits: Thevenin's Theorem, Norton's Theorem and MaximumPower Transfer Theorem.

Applications: Source Modeling, Resistance Measurement

UNIT–IV: TWO PORT NETWORKS AND COUPLED CIRCUITS 12 HOURS

Two port Networks: Introduction to Two Port networks, open circuit impedance parameters, short circuit admittance parameter, Transmission parameters, Hybrid parameters. Relationship among parameters, Interconnection of two-port networks: Series, Cascade and ParallelConnections

Coupled circuits: Self and Mutual inductances, dot convention, coefficient of coupling, Analysisof coupled circuits.

Applications: Transformer and Transistor Circuits, Ladder Network Synthesis.

UNIT-V: DC TRANSIENTS 12 HOURS

First Order Circuits: Introduction to Transient and Steady State Analysis, Initial Conditions, The Source-Free RC Circuit, The Source-Free RL Circuit, Step Response of an RC Circuit, Step Response of an RL Circuit.

Second Order Circuits: The Source-Free Series RLC Circuit, Step Response of a Series RLC Circuit.

Applications: Delay Circuits and Relay Circuits

Text Books

1. Hayt, Kemmerly and Durbin "Engineering Circuit Analysis", TMH 7th Edition, 2010.

2. Charles K Alexander and Mathew N O Sadiku, "Fundamentals of Electric Circuits", TataMcGraw-Hill, 3rd Ed, 2009.

Reference Books

1. John D. Ryder "Networks, Lines and Fields", PHI, 2nd edition, 2009.

2. Edminister "Electric Circuits – Schaum's Outline Series", McGraw-Hill,2009.

3. 4. Ravish R., Network Analysis and Synthesis, 2/e, McGraw-Hill, 2015.

E- Resources

1) https://nptel.ac.in/courses/108/104/108104139/
2) https://nptel.ac.in/courses/108/105/108105159/

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

CO1	**Apply** matrix algebra and engineering tools like mesh and node methodsto solve various DC circuit problems **{Apply level, KL3}**
CO2	**Match** concepts in trigonometry, complex algebra to utilize techniques, skills to solve the AC circuit problems under steady state conditions. **{Apply level, KL3}**
CO3	**Select** proper network reduction techniques, circuital laws and theorems to analyze the both DC and AC circuit problems effectively. **{Understand level, KL2}**
CO4	**Learns** and **gain** the knowledge on characteristics of two port network parameters (Z, Y,ABCD, h & g) and **solves** for parameter for any sort of two port network. **{Understand** **level, KL2}**
CO5	**Analyze** the DC transients in RL, RC and RLC circuits in detail using solutions of homogeneous and non-homogeneous differential equations.**{ Analyze level, KL4}**

I-Year-II Semester ES1206	PROBLEM SOLVING USING PYTHON	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn about Python programming language syntax, semantics, and the runtimeenvironment
2. To be familiarized with universal computer programming concepts like data types, containers
3. To be familiarized with general computer programming concepts like conditional execution,loops & functions
4. To be familiarized with general coding techniques and object-oriented programming

UNIT-I: 14 HOURS

Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops,
Nested Loops.

UNIT-II: 12 HOURS

Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and ifelse Statement Conditional Iteration, While Loop

Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption,
Strings and Number Systems, String Methods Text Files.

UNIT-III: 13 HOURS

List and Dictionaries: Lists, Defining Simple Functions, Dictionaries

Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a FileSystem, Managing a Program's Namespace, Higher Order Function.

Modules: Modules, Standard Modules, Packages.

UNIT–IV: 13 HOURS

File Operations: Reading config files in python, Writing log files in python, Understanding readfunctions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support

Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM,

Structuring Classes with Inheritance and Polymorphism.

UNIT-IV: 12 HOURS

Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.

Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources.

Programming: Introduction to Programming Concepts with Scratch.

Text Books

1. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference Books

1. Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
2. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

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

CO1	Develop essential programming skills in computer programming concepts like data types, containers.
CO2	Solve coding tasks related to conditions, loops and String processing.
CO3	Experiment with various Data structures in interpreted Language and to build modules and packages for real software needs.
CO4	Implement Files and object-oriented principles in Python.
CO5	Identify solutions using GUI in Python.

I-Year-II Semester

ES1207L

BASIC ELECTRICAL ENGINEERING LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To analyze a given network by applying various electrical laws and network theorems.
2. To know the response of electrical circuits for different excitations.
3. To analyze the performance characteristics of DC machines.
4. To measure and calculate the performance characteristics of 1-phase Transformer.
5. To analyze the performance characteristics of AC machines.

List of Experiments:

Any ten of the following experiments to be conducted

1. Verification of Ohms Law, KVL and KCL.
2. Verification of super position theorem.
3. Verification of Thevenin's and Norton's theorems.
4. Verification of Maximum power transfer theorem.
5. Verification of Reciprocity theorem.
6. Draw the OCC of DC Shunt Generator.
7. Draw the performance characteristics of DC Shunt Motor.
8. Speed control of DC Shunt Motor-Armature and field control methods.
9. Swinburne's test on DC machine.
10. OC & SC tests on Single phase Transformer.
11. Performance Characteristics of a Three-phase Induction Motor
12. Regulation of alternator by synchronous impedance method.

Text books:

1. Principles of Electrical Machines by V.K. Mehta & Rohit Mehta, S.Chand publications.
2. Theory & performance of Electrical Machines by J.B.Guptha, S.K.Kataria &Sons

Reference books:

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH publications.
2. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition.
3. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.

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

CO1	Able to analyze a given network by applying electrical laws and network theorems.
CO2	Able to know the response of electrical circuits for different excitations.
CO3	Able to analyze the performance characteristics of DC machines.
CO4	Able to measure and calculate the performance characteristics of 1-phase Transformer.
CO5	Able to analyse the performance characteristics of AC machines.

I-Year-II Semester

BS1210L

APPLIED CHEMISTRY LAB

L	T	P	C
0	0	3	1.5

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

Course Objectives:

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

List of Experiments:

Students should do any 10 experiments listed below

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

16. Preparation of nylon-6, 6 and Bakelite (demonstration only)

Reference books:
1. A Text Book of Quantitative Analysis, Arthur J. Vogel.

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

CO1	To estimate the amount of metal ions, present in different solutions (L4 & L3)
CO2	To analyze the quality parameters of water (L4)
CO3	To determine the strength of different solutions by using different instrumentation techniques (L3)

I-Year-II Semester

ES1208L

L	T	P	C
0	0	3	1.5

PROBLEM SOLVING USING PYTHON LAB

Course Objectives:

1. To acquire programming skills in core Python.
2. To acquire Object Oriented Skills in Python
3. To develop the skill of designing Graphical user Interfaces in Python
4. To develop the ability to write database applications in Python

List of Problems:

1. Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2. Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3. Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
4. Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
5. Use a *for* loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

```
*

**

***

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6. Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.

7. Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and Not close otherwise.
8. Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9. Write a program that asks the user to enter two strings of the same length. The programshould then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde* and *ABCDE* the program should print out *AaBbCcDdEe*.Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.
10. In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.
11. Write a program that generates a list of 20 random numbers between 1 and 100.
    a) Print the list.
    b) Print the average of the elements in the list.
    c) Print the largest and smallest values in the list.
    d) Print the second largest and second smallest entries in the list
    e) Print how many even numbers are in the list.
12. Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.
13. Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is 4.
14. Write a program that removes any repeated items from a list so that each item appears at mostonce. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].
15. Write a program that asks the user to enter a length in feet. The program should then give the user the option to

convert from feet into inches, yards, miles, millimeters, centimeters,meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, itis much shorter with lists and it is also easier to add new conversions if you use lists.

16. Write a function called *sum_digits* that is given an integer num and returns the sum of the digits of num.
17. Write a function called *first_diff* that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.
18. Write a function called *number_of_factors* that takes an integer and returns how many factorsthe number has.
19. Write a function called *is_sorted* that is given a list and returns True if the list is sorted and False otherwise
20. Write a function called root that is given a number x and an integer n and returns $x^{1/n}$. In the function definition, set the default value of n to 2.
21. Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be 100.
22. Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
    a) Do this using the sort method. b) Do this without using the sort method.
23. Write a program that asks the user for a word and finds all the smaller words that can be madefrom the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.
24. Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
25. Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.
26. Write a class called Product. The class should have fields called name, amount, and price, holding the product's

name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price* that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is chargedfor orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase* that receives the number of items to be bought and decreases amount by that much.

27. Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes* that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours* that returns a string of hours, minutes, and seconds formatted analogously to the previous method.
28. Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c.feet() and should get 0.75 as the result.
29. Write a Python class to implement pow(x, n).
30. Write a Python class to reverse a string word by word.
31. Write a program that opens a file dialog that allows you to select a text file. The program thendisplays the contents of the file in a textbox.
32. Write a program to demonstrate Try/except/else.
33. Write a program to demonstrate try/finally and with/as.

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

CO1	Comprehend how software easily to build right out of the box.
CO2	Demonstrates the use of an interpreted language for problem solving through control statements including loops and conditionals.

CO3	Practice with data structures for quick programming solutions.
CO4	Demonstrates software building for real needs by breaking out code into reusable functions and modules.
CO5	Comprehend the software reliability through exception handling.

I-Year-II Semester MC1201	INDIAN CONSTITUTION	L	T	P	C
		2	0	0	0

Course Objectives

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

UNIT-I:

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and

Duties, Directive Principles of State Policy.

UNIT-II:

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

and Functions.

UNIT-III:

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

UNIT–IV:

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Panchayati: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy -

(Different departments), Village level - Role of Elected and

Appointed officials - Importance of grass root democracy.

UNIT-V:

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions of Commissions for the welfare of

SC/ST/OBC and women.

Reference Books

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

E-Resources

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

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

CO1	Understand historical background of the constitution making and its importance for building a democratic India.
CO2	Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
CO3	Understand the value of the fundamental rights and duties for becoming good citizen of India.
CO4	Analyze the decentralization of power between central, state and local self-government.
CO5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

II-Year-I Semester BS2112	MATHEMATICS – III	L	T	P	C
		3	0	0	3

Pre-Requisites: Calculus, Multiple Integration, Set Theory

Course Objectives:

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

UNIT-I: SOLVING SYSTEM OF LINEAR EQUATIONS, EIGEN VALUES AND EIGEN VECTORS 12 HOURS

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

Eigen values and Eigen vectors and their properties.

UNIT-II: CAYLEY-HAMILTON THEOREM AND QUADRATIC FORMS 12 HOURS

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

Application: Free vibration of two mass systems.

UNIT-III: VECTOR DIFFERENTIATION 10 HOURS

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

UNIT–IV: VECTOR INTEGRATION 13 HOURS

Line integral – Work done – Circulation- Surface integral- Volume integral.

Vector integral theorems (without proof): Green's theorem in a plane- Stokes theorem- GaussDivergence theorem.

UNIT-V: SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 14

HOURS
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations. Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS term of the type e^{ax_by} ,$\sin(ax \square by)$,$\cos(ax \square by)$, $x^m y^n$.

Text Books
1. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
Reference Books:
1. B.V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw HillEducation. 2. H.K. Das, Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd. 3. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.
E-resources
1. https://www.freebookcentre.net/maths-books-download/Linear-Algebra-A-free-Linear-Algebra-Textbook-and-Online-Resource.html

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

CO1	Develop the use of matrix algebra techniques that is needed by engineers for practical applications
CO2	Solve system of linear algebraic equations using Gauss elimination, Gauss Jordan
CO3	To interpret the physical meaning of different operators such as gradient, curl and divergence
CO4	Estimate the work done against a field, circulation and flux using vector calculus
CO5	Identify the solution methods for partial differential equation that model physical processes

II-Year-I Semester PC2101	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
		3	0	2	3

Pre-Requisites: Engineering Physics

Course Objectives:

1. To instill the fundamentals of diode operation
2. To understand the implementation of various diode applications
3. To familiarize with the physics and working of transistors
4. To learn how to bias various transistor devices
5. To learn small-signal models of Transistors

UNIT-I:

Junction Diode Characteristics 11 HOURS

Review of semiconductor Physics formation of PN-Junction, Electrical representation, Energy Band Model and Barrier potential (quantitative treatment), Forward and Reverse bias characteristics of PN-junction Diode (Qualitative), Diode current equation, Junction resistance, Diode circuit models, Transition and Diffusion Capacitance.

Special Semiconductor Devices 04 HOURS

Breakdown mechanisms in diodes, V-I Characteristics of Zener diode, Varactor Diode, Tunnel Diode, LED, photo diode, SCR and UJT.

UNIT-II: DIODE APPLICATIONS 12 HOURS

Diode as switch, Components of Power Supply, working and Characteristics of Half-wave, Full- Wave and Bridge rectifiers, Working of Full Wave Rectifier with series Inductor , shunt capacitor filters and L , Pi section filters(qualitative), Zener Diode as shunt voltage regulator and design of

voltage regulator. Applications of rectifiers and voltage regulators.

UNIT-III:

Bi-polar Junction Transistors (BJT) 07 HOURS

N-P-N and P-N-P transistors structure, Operation of BJT, Early effect, Current equations, Input and Output characteristics of CB, CE and CC, BJT as an Amplifier

Junction Field Effect Transistors (JFET) 04 HOURS

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

Metal-Oxide-Semiconductor Field Effect Transistors (MOSFET) 04 HOURS Structure of Depletion-MOSFET and Enhancement-MOSFETs, V-I Characteristics of MOSFET, Significance of threshold voltage.

Uni-Junction Transistor(UJT) 01 HOUR

Construction and working of UJT

UNIT–IV: TRANSISTOR BIASING 12 HOURS

Need for Proper Biasing, Q-point stability, Fixed, Collector to Base bias and Voltage Divider

biasing for BJT, Emitter Degeneration, Design of Self Biasing circuit, Thermal Stabilityconsiderations. Fixed, Voltage Divider biasing for JFET and MOSFETs.

UNIT-V: SMALL SIGNAL LOW FREQUENCY ANALYSIS OF BJT AND FET AMPLIFIERS 12 HOURS

Small signal low frequency analysis of BJT using h parameter model and $r\pi$ model. Determination of h-parameters from transistor characteristics, Analysis of CE, CC, CB Amplifiers. Simplified h- parameter model, analysis of CE Amplifier with emitter resistance.

Small Signal Model, Analysis of JFET Amplifiers, Analysis of CS, CD JFET Amplifiers.

Text Books

1. Jacob Millman and Halkias, “Electronic Devices and Circuits”, Tata-Mcgraw HillSecond Edition, 2007.
2. Robert L. Boylestead and Louis Nashelsky, “Electronic Devices and Circuit Theory”,

Pearson Education Inc. Eleventh Edition 2013.

Reference Books

1. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford UniversityPress, 2004 Edition.
2. D. A. Neaman, "Semiconductor Physics and Devices", Times Mirror High EducationGroup, Chicago, 1997.
3. Jacob Millman and Halkias, "Integrated Electronics",Tata Mc-Graw Hill,Second Edition, 2009.

E-resources

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

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

CO1	Describe the working of junction diodes and interpret V-I relations **(Understand)**
CO2	Demonstrate the usage of diodes in various applications **(Apply)**
CO3	**Explain** the working principles of BJTs and FETs **(Understand)**
CO4	**Learn** the art of biasing of BJTs and FETs **(Apply)**
CO5	**Apply** the equivalent small signal low frequency models of BJTs and FETS in amplifieranalysis **(Analyze)**

II-Year-I Semester PC2102	SIGNALS AND SYSTEMS	L	T	P	C
		2	1	0	3

Pre-Requisites: Engineering Mathematics-1 and 3

Course Objectives:

1. Describe signals mathematically and understand how to perform mathematical operations on signals and Compute the Fourier series of a set of well-defined signals from first principles.
2. Compute the Fourier transform of a set of well-defined signals and Understand the Nyquist sampling theorem and the process of reconstructing a continuous- time signalfrom its samples.
3. Perform the process of convolution and correlation between signals and Compute the output of an LTI system given the input and the impulse response through convolution sum and convolution integral.
4. Understand Laplace transforms and their properties for analysis of signals andsystems.
5. Understand Z-transforms and their properties for analysis of signals andsystems.

UNIT-I: SIGNALS ANALYSIS AND FOURIER SERIES

Signal Analysis **09 HOURS**

Signal definition (continuous and discrete), Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Classification of signals. Time operations on signals. Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions.

Fourier Series **06 HOURS**

Representation of Fourier series, Dirichlet‟s conditions, Properties of Fourier Series, Trigonometric Fourier Series and Exponential/ Complex Fourier Series, Complex Fourier spectrum.

UNIT-II: FOURIER TRANSFORM AND SAMPLING THEOREM

Fourier Transform 08 HOURS

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

Sampling Theorem 05 HOURS

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

UNIT-III:

Signal transmission through Linear Time Invariant (LTI) Systems 07 HOURS

System definition (continuous and discrete), Classification of Systems, impulse response, transfer function, LTI system response, Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

Convolution and Correlation 09 HOURS

Concept of convolution, convolution in time and frequency domain properties of Fourier Transform, graphical and analytical convolution, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and energy/power spectral density spectrum.
Relation between convolution and correlation

UNIT–IV: LAPLACE TRANSFORMS 08 HOURS

Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence(ROC) for Laplace Transforms, Properties of ROC of Laplace Transform, Properties of Laplace Transform, Relation between LT and Fourier Transform of a signal, Response of LTI system using Laplace Transform,
Laplace transform of causal periodic signals, Laplace transform of certain signals using waveform synthesis.

UNIT-V: Z-TRANSFORMS **08 HOURS**

Concept of Z- Transform and Inverse Z-Transform, Distinction between Laplace, Fourier and Z -transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Properties of ROC of Z-Transform, Properties of Z-transforms, Inverse Z-transform, Response of LTI system using Z-Transform, Introduction to DTFT, Relationship between Z-Transform and DTFT, Conversion from Laplace transform to Z-transform and vice- versa.

Text Books

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H.Nawab, 2nd Edn,PHI, 1997.
3. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2ndEdition,2007

Reference Books

1. Principles of Linear Systems and Signals by B. P. Lathi, 2nd Edition, Oxfordpublications, 2015.
2. Fundamentals of Signals and Systems- Michel J. Robert, 2nd Edition, MGHInternational Edition, 2008.
3. Signals and Stochastic Processes by Y Mallikarjuna Reddy and Giri Babu Kande,1st edition, University Press, 2017.

E-Resources

1. https://nptel.ac.in/courses/108/106/108106163/
2. https://nptel.ac.in/courses/108/104/108104100/
3. https://nptel.ac.in/courses/108/105/108105065/
4. https://nptel.ac.in/courses/117/104/117104074/
5. https://nptel.ac.in/courses/117/101/117101055/
6. https://nptel.ac.in/courses/108/106/108106075/

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

CO1	The student will be able to understand various types of signals

	mathematically and able to calculate complex Fourier spectrum. **(Understand, Calculate)**
CO2	Analyse the continuous-time signals and continuous-time systems using Fourier transform and **Apply** sampling theorem to convert continuous-time signals to discrete- time signal and reconstruct the original signal from samples. **(Analyse, Apply)**
CO3	Define systems based on their properties and determine the response of LTI system. Understand the concept convolution, correlation, energy spectral density and power spectral density. **(Remember, Understand)**
CO4	Compute Laplace transforms to analyze continuous time signals and systems and understand the concept of region of convergence. **(Compute)**
CO5	Compute Z-transform to analyze discrete-time signals and systems, and understand the concept of region of convergence. **(Compute)**

II-Year-I Semester PC2103	DIGITAL CIRCUITS AND LOGIC DESIGN	L	T	P	C
		3	0	2	3

Pre-Requisites: Nil

Course Objectives:

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

UNIT-I: NUMBER SYSTEMS AND BOOLEAN ALGEBRA 11 HOURS

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

Boolean Algebra: Boolean algebra and logic gates, Basic theorems and properties of Boolean

Algebra, Boolean functions, canonical and standard forms, Universal Gates.

UNIT-II: MINIMIZATION METHODS OF BOOLEAN FUNCTIONS 10 HOURS

Minimization of logic expressions by algebraic method, Sum of Products (SOP), Product of Sums (POS), K-Map Method, Don‟t Care Combinations, Multilevel NAND/NOR realizations, Prime and essential Prime Implicants, Tabular Method, Prime Implicants Chart,

Simplification Rules.

UNIT-III: COMBINATIONAL CIRCUITS 13 HOURS

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

MUX/Decoder, Magnitude Comparator, Programmable logic devices.

UNIT–IV: SEQUENTIAL CIRCUITS 10 HOURS

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

Registers and Counters: Shift Registers Left, Right and Bidirectional Shift Registers,

Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter,Operation of Asynchronous and Synchronous Counters.

UNIT-V: SEQUENTIAL MACHINES 08 HOURS

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

Text Books

1. Digital Design by M. Morris Mano, Michael D Ciletti, 4th edition, PHI publication, 2008
2. Switching and finite automata theory Zvi. KOHAVI, Niraj. K. Jha, 3rdEdition, CambridgeUniversity Press,2009
3. Switching theory and logic design by Hill and Peterson, Mc-Graw Hill TMH edition, 2012.

Reference Books

1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers, 2016
2. Modern Digital Electronics by RP Jain, 4th edition TMH, 2009
3. Switching Theory and Logic Design by A. Anand Kumar, PHI Learning Pvt

ltd, 2016.
E-Resources
1. https://nptel.ac.in/courses/117/106/117106086/ 2. https://nptel.ac.in/courses/108/105/108105113/ 3. https://www.coursera.org/learn/digital-systems 4. https://swayam.gov.in/nd1_noc20_ee70/preview

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

CO1	Distinguish the analog and digital systems, apply positional notations, number systems, computer codes in digital systems. **(Remember, Understand, and Apply)**
CO2	Understand the Boolean Algebra theorems, simplify and design logic circuits.**(Understand, Apply, Analyze and valuate)**
CO3	Implement combinational logic circuit design and modular combinational circuits using encoders, decoders, multiplexers and demultiplexers. (**Apply, Analyze, valuate, and create)**
CO4	Understand the basic elements of sequential logic circuits. **(Understand, Apply, Analyze)**
CO5	Design and analyze sequential circuits. **(Apply, Analyze and create)**

II-Year-I Semester	RANDOM VARIABLES & STOCHASTIC PROCESSES	L	T	P	C
BS2113		3	0	0	3

Pre-Requisites: Mathematics

Course Objectives:

1. To give students an introduction to elementary probability theory, in preparation forcourses on statistical analysis, random variables and stochastic processes.
2. To introduce the important concepts of random variables and stochastic processes.
3. To gain knowledge of standard distributions this can describe real life phenomena.
4. To analyze the LTI systems with stationary random process as input.
5. To introduce the types of noise and modeling noise sources.

UNIT-I: THE RANDOM VARIABLE 10 HOURS

Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties, Practical examples of Random variables and different distribution functions.

UNIT-II: OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS 10 HOURS

Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.

UNIT-III: MULTIPLE RANDOM VARIABLES 08 HOURS

Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

OPERATIONS ON MULTIPLE RANDOM VARIABLES 08 HOURS

Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables, Practical examples.

UNIT–IV: RANDOM PROCESSES – TEMPORAL & SPECTRAL CHARACTERISTICS 12 HOURS

The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, the Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross-Correlation Function

UNIT-V: LINEAR SYSTEMS WITH RANDOM INPUTS & MODELLING OF NOISE SOURCES 12 HOURS

Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Band pass, Band- Limited and Narrowband Processes, Properties, Resistive (Thermal) Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Average Noise Figure, Average Noise Figure of cascaded networks., Practical examples.

Text Books

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4thEdition, 2001
2. Probability Theory and Stochastic Processes, Y. Mallikarjuna Reddy, universities press, 4th edition, 2013.
3. Schaum's Outline of Probability, Random Variables, and Random Processes.

Reference Books

1. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis andS.Unnikrisha, PHI, 4th Edition, 2002.
2. Principles of Communication systems by Taub and Schilling (TMH), 2008.
3. Statistical Theory of Communication – S.P Eugene Xavier, New Age Publications,2003.
4. R.P. Singh and S.D. Sapre, "Communication Systems Analog & Digital", TMH, 1995.
5. Henry Stark and John W.Woods, "Probability and Random Processes with Applicationto Signal Processing", Pearson Education, 3rd Edition.
6. George R. Cooper, Clave D. MC Gillem, "Probability Methods of Signal and SystemAnalysis", Oxford, 3rd Edition, 1999.

E-Resources

1. https://nptel.ac.in/courses/108/106/108106163/
2. https://nptel.ac.in/courses/108/104/108104100/
3. https://nptel.ac.in/courses/108/105/108105065/
4. https://nptel.ac.in/courses/117/104/117104074/
5. https://nptel.ac.in/courses/117/101/117101055/
6. https://nptel.ac.in/courses/108/106/108106075/

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

CO1	Mathematically model the random phenomena and solve simple probabilistic problems.**(Understand, Apply)**
CO2	Identify different types of random variables and compute statistical averages of these random variables.**(Analyse, Apply, Compute)**
CO3	Learn how to deal with multiple random variables, conditional probability and conditional expectation, joint distribution and independence, mean square estimation. **(Analyse, Apply, Compute)**

CO4	Characterize the random processes in the time and frequency domains. **(Define, Understand)**
CO5	Analyse the LTI systems with random inputs and to Construct and analyse the mathematical modelling of noise sources. **(Define, Analyse, Apply, Compute)**

II- Year-I Semester

PC2101 **ELECTRONIC DEVICES AND CIRCUITS LAB**

L	T	P	C
0	0	3	1.5

Course Objectives:

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

Electronic Workshop Practice:

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs,LEDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. V-I characteristics of Junction diode (Both Silicon and Germanium Diodes).
2. V-I characteristics of Zener diode.
3. Half Wave Rectifier with and without Capacitor filter
4. Centre-tap Full Wave Rectifier with and without capacitor filter
5. Bridge Rectifier with and without capacitor filter
6. Zener diode as voltage regulator (design).
7. BJT characteristics (CB-input, output characteristics and measurement of device parameters).
8. BJT characteristics (CE-input, output characteristics and measurement of device parameters).
9. JFET Characteristics (Drain, transfer characteristics and

measurement of parameters).

10. MOSFET characteristics (drain, transfer characteristics and measurement of device parameters).
11. JFET/MOSFET voltage-divider bias circuit
12. Design of CE amplifier with self-bias.
13. Design of variable DC power supply (application).

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

CO1	Measure voltage, frequency and phase of any waveform using CRO.**(Understand)**
CO2	Generate sine, square and triangular waveforms with required frequency and amplitude using function generator. **(Apply)**
CO3	Analyze the characteristics of different electronic devices such as diodes, transistors etc. **(Apply)**
CO4	Apply the diode working principles to design simple circuits like rectifiers, power supplies and amplifiers etc. **(Apply)**
CO5	Design the BJT amplifier circuit for the given operating conditions and specifications. (**Apply)**

II-Year-I Semester
PC2105L

SIGNALS AND SYSTEMS LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To observe different signals and operations on signals.
2. To study Fourier Transform/Series and sampling theorem.
3. To study continuous time and discrete time systems.
4. To observe convolution.

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Introduction to Relational Operators, Loops & Functions, Matrix Operations.
2. Exercises on understanding complex numbers, Tylor‟s and Euler‟s series, finding theroots of linear system of equations.
3. Loading and printing/playing/displaying multimedia files.
4. Construction of elementary signals, operations on those signals, synthesis of some deterministic musical notes and the generation of their echo, delay & reverberation.
5. Periodic signals, synthesis of signals using Fourier series and Gibbs phenomenon
6. Fourier transforms and verification of its properties.
7. Sampling, reconstruction, rate conversion and investigation of aliasing effect.
8. Determining the transfer functions of analog filters using Laplace transforms and their analysis using pole-zero plots.
9. Determination of the transfer function of a system constructed by the interconnection of several sub systems
10. Understanding z-transforms and Frequency Responses of a causal discrete- time LTI system implemented using the difference equation.

11. Convolution on Continuous Time Signals with application of smoothing some noisy speech or any one dimensional real signal (data files are to be provided).

12. Filtering Periodic Signals.

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

CO1	Understand the Basics of Matlab and solve Linear systems of equations.**(Understand)**
CO2	Construct different Elementary signals and work with different Multimedia signals using Matlab**(Apply)**
CO3	Analyse different signals using Fourier Transform and Series and understand the process of sampling using Matlab**(Analyze)**
CO4	Determine the transfer function of LTI systems using Laplace and Z Transform using Matlab **(Analyze)**
CO5	Apply convolution to find the response of LTI systems using Matlab **(Apply)**

II- Year-I Semester
PC2106L

DIGITAL CIRCUITS AND LOGIC DESIGN LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To learn different ICs used for logic gates.
2. To understand the working of combinational and sequential circuits by using hardware components

List of Experiments: (Minimum of Twelve Experiments has to be performed)

1. Verification of truth tables of Logic gates

Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR

2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit

3. Verification of functional table of 3 to 8 line Decoder /De-multiplexer

4. 4 variable logic function verification using 8 to 1multiplexer.

5. Design full adder circuit and verify its functional table.

6. Verification of functional tables of

   (i) J K Edge triggered Flip –Flop

   (ii) J K Master Slave Flip – Flop (iii)D Flip -Flop

7. Design a four bit ring counter using D Flip – Flops / JK Flip Flop and verify output

8. Design a four bit Johnson's counter using D Flip-Flops / JK Flip Flops and verify output

9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.

10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test it with a

low frequency clock and Sketch the output waveforms.

11. Design MOD – 8 synchronous counter using T Flip-Flop and verify the result and Sketch theoutput waveforms.

12. (a) Draw the circuit diagram of a single bit comparator and test the output

    (b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.

ADD on Experiments:

1. Design BCD Adder Circuit and Test the Same using Relevant IC

2. Design Excess-3 to 9-Complement convertor using only four Full Adders and test theCircuit.

3. Design an Experimental model to demonstrate the operation of74154 De-Multiplexer usingLEDs for outputs.

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

CO1	Understand the working of basic logic gates. **(Understand)**
CO2	Construct basic Combinational circuits and verify their functionalities. **(Analyze)**
CO3	Apply the design procedures to design Sequential circuits. **(Apply)**
CO4	Learn about Counters and Shift registers. **(Analyze)**
CO5	Understand the basic digital circuits and verify their operations. **(Understand)**

II-Year-I Semester	DATA PRE-PROCESSING AND VISUALIZATION	L	T	P	C
SC2101		1	0	2	2

Pre-Requisites: Fundamentals of Python Programming

Course Objectives:

1. To introduce classes in Python
2. To understand I/O and error handling
3. To introduce relational databases
4. To implement machine learning algorithms
5. To familiarize student with various steps in data analysis, visualization and Python data pre-processing techniques

UNIT-I: INTRODUCTION TO PYTHON

Use IDLE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, working with lists, work with a list of lists, work with tuples, work with dates and times, get started with dictionaries.

UNIT-II: CLASSES IN PYTHON

OOPS Concepts, Classes and objects , Classes in Python, Constructors,Data hiding, Creating

Classes, Instance Methods, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes, Iterators, generators and decorators.

UNIT-III: I/O AND ERROR HANDLING IN PYTHON

Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Handling IO Exceptions, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Working with Directories.

UNIT-IV: AN INTRODUCTION TO RELATIONAL DATABASES

SQL statements for data manipulation, Using SQLite Manager to work with a database, UsingPython to work with a database, creating a GUI that handles an

event, working with components.
UNIT-V: IMPLEMENT MACHINE LEARNING ALGORITHMS Usage of Numpy for numerical Data, Usage of Pandas for Data Analysis, Matplotlib for Python plotting, Seaborn for Statical plots, interactive Dynamic visualizations, SciKit for Machinelearning.

TEXT BOOKS

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2. Haltermanpythonhttps://github.com/halterman/PythonBook-SourceCode
3. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010
4. Charles Severance et al, Python for Everybody: Exploring Data in Python 3
5. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly Media; 1st edition (November 21, 2016)

ONLINE RESOURCES:

1. https://www.w3schools.com/python
2. https://docs.python.org/3/tutorial/index.html
3. https://www.python-course.eu/advanced_topics.php

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

CO1	Remember the basics of Python. **(Remember)**
CO2	Understand the Classes, I/O and error handling. **(Understand)**
CO3	Implement the SQL statements **(Apply)**
CO4	Implement Machine Learning Algorithms. **(Apply)**
CO5	Understand the working of Numpy, Pandas on data. **(Understand)**

II-Year-I Semester	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
MC2102		2	0	0	0

Pre-Requisites: Nil

Course Objectives:

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

UNIT-I:

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

knowledge.

UNIT-II:

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

UNIT-III:

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

UNIT–IV:

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

Traditional Knowledge.

UNIT-V:

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of

environment, Management of biodiversity, Food security of the country and protection of TK.

Text Books

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

E-Resources

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

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

CO1	Understand the concept of Traditional knowledge and its importance. **(Understand)**
CO2	Know the need and importance of protecting traditional knowledge.

	(Understand)
CO3	Understand legal framework of TK, Contrast and compare the ST and other traditional forest dwellers. **(Understand)**
CO4	Know the various enactments related to the protection of traditional knowledge. **(Understand)**
CO5	Understand the concepts of Intellectual property to protect the traditional knowledge. **(Understand)**

II-Year-II Semester
PC2207

ANALOG CIRCUITS

L	T	P	C
3	0	0	3

Pre-Requisites: Electronic Devices and Circuits, Network Analysis

Course Objectives:

1. To **understand** the concept of Linear and Non Linear wave shaping
2. To **analyz**e various amplifier circuits using BJT and MOSFET at high frequencies andmultistage amplifiers.
3. To **familiarize** the concept of feedback in amplifiers and **analysis** of different types offeedback amplifiers.
4. To **analyze** and **design** different types of oscillator circuits.
5. To **understand** different types of power amplifiers and perform **analysis** of tuned circuits.

UNIT-I:

Linear Wave Shaping: 07 HOURS

High pass and low pass RC circuits, Response to sine, step, pulse, square, and ramp inputs with different time constants, High pass as a differentiator, Low pass as an Integrator

Nonlinear Wave Shaping: 07 HOURS

Diode clippers, Transfer characteristics of clippers, series and shunt clippers, clipping at twoindependent levels, Clamping operation, Clamping circuit theorem.

UNIT-II:

Multistage Amplifiers: 07 HOURS

Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascaded RC Coupled amplifiers, Cascode amplifier, Darlington pair.

Transistor at High Frequency: 07 HOURS

Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductances, Hybrid π capacitances, validity of hybrid π model,

Miller effect, Hybrid - model of Common Emitter transistor model, fα, fβ and unity gain bandwidth, Analysis of common

source and common drain amplifiers at high frequencies.

UNIT-III: FEEDBACK AMPLIFIERS 10 HOURS

Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback

amplifiers and Simple problems.

UNIT–IV: OSCILLATORS 08 HOURS

Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LCtype Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, crystal oscillators.

UNIT-V:

Large Signal Amplifiers: 07 HOURS

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

Tuned Amplifiers: 07 HOURS

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

Text Books

1. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, McGraw-Hill
2. Pulse and Digital Circuits – A. Anand Kumar, PHI, 2005.
3. Millman and Halkias: Integrated Electronics, Tata Mc.Graw Hill, 2004.
4. Sedra and Smith: Microelectronic Circuits, 4/e, Oxford University Press 1998.
5. B. Razavi , “Fundamentals of Microelectronics”, Wiley.

Reference Books

1. Donald A Neamen.: Electronic Circuit Analysis and Design, 3/e, Tata Mc.Graw Hill.
2. R E Boylstead and L Nashelsky: Electronic Devices and Circuit Theory, 9/e, PearsonEducation.
3. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, Mothiki S PrakashRao McGraw-Hill, Second Edition, 2007.
4. Solid State Pulse circuits - David A. Bell, PHI, 4th Edn., 2002.

E-Resources

1. https://nptel.ac.in/courses/117/106/117106087/
2. https://nptel.ac.in/courses/117/106/117106088/
3. https://nptel.ac.in/courses/108/105/108105158/
4. https://www.youtube.com/playlist?list=PL7qUW0KPfsIIOPOKL84wK_Qj9N7gvJX6v
5. https://www.youtube.com/playlist?list=PLm2lpI_krGU5p0EHm1MArCs4hb99KOVzp

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

CO1	**Analyze**the RC circuits for low pass and high pass filtering and design clippers and clampers for various applications **(Analyze)**
CO2	**Apply** and **Analyze** various amplifier circuits using BJT and MOSFET at high frequencies and multistage amplifiers. **(Apply, Analyze)**
CO3	**Familiarize** the concept of feedback in amplifiers and **analysis** of different types of feedback amplifiers.**(Familiarize, Analyze)**
CO4	**Analyze** and **Design** different types of oscillator circuits.**(Analyze)**
CO5	**Understand** different types of power amplifiers and perform **analysis** of single tuned circuits. **(Understand, Analyze)**

II-Year-II Semester PC2208	ELECTROMAGNETIC FIELDS & WAVES	L	T	P	C
		2	1	0	3

Pre-Requisites: Signals and Systems

Course Objectives:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on the concepts of electrostatics, electric potential, energy densityand their applications.
3. To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar andvector potential and its applications.
4. To impart knowledge on the concepts of Faraday's law, induced EMF and Maxwell'sequations.
5. To impart knowledge on the concepts of electromagnetic waves.

UNIT-I: ELECTROSTATICS-1 15 HOURS

Review of Vector Analysis, orthogonal Coordinate Systems, Electric Charge, Coulomb's Force Law, Electric Field Intensity, Charge Distributions, Field Due to line, sheet and volume charge distributions, Concept of Electric Flux, Electric Flux Density, Gauss Law and Applications, Divergence, Divergence theorem, Maxwell's First equation of Electrostatics.

UNIT-II: ELECTROSTATICS-2 15 HOURS

Work in Electric field and Electric Potential, Gradient of Potential, Maxwell's second Equation for Electrostatic Fields, Electric Dipole, Electrostatic Energy and Energy Density. Convection and Conduction Currents, Electric Field in Dielectrics and Conductors, Electrostatic Boundary Conditions, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations;

Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

UNIT-III: THE STEADY MAGNETIC FIELD 12 HOURS

Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Curl and Stokes Theorem, Maxwell's First Equation for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Maxwell's Second Equation for Magnetostatic Fields, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy, Magnetostatic Boundary Conditions

Illustrative Problems.

UNIT–IV: MAXWELL'S EQUATIONS FOR TIME VARYING FIELDS 08 HOURS

Review of Maxwell's Equations For Static Fields in differential and Integral forms, Introduction to Time varying Fields, Faraday's Law, Transformer e.m.f, Lenz's Law, Motional e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements.

UNIT-V: EM WAVE CHARACTERISTICS 15 HOURS

Solution of Maxwell's Equations for time varying fields, EM Wave Equations for Different media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Phenomenon in Free Space, Lossless, Lossy dielectrics, Wave Propagation in good conductors, skin depth, Wave Polarization & Types. Illustrative Problems.

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, Power carried by EM Wave, Poynting Vector, Poynting Theorem –

Applications.

Text Books

1. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.
2. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
3. Electromagnetic Wave s and Transmission Lines - Y.Mallikharjuna Reddy, UniversitiesPress (India) Pvt. Ltd.

Reference Books

1. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed.,2006.
2. Engineering Electromagnetics - Nathan Ida, Springer(India)Pvt.Ltd., New Delhi, 2nded., 2005.
3. Schaum's Outline of Electromagnetics - Joseph Edminister and Mahmood Nahvi, fourthedition

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

CO1	Use the concepts of vectors and space coordinates to solve the fundamental problems of static electric fields.
CO2	Apply principles of static electric field to understand the behaviour of dielectrics and conductors.
CO3	Understand the principles of steady magnetic field.
CO4	Solve the Maxwell's equations of Time Varying fields and obtain the wave phenomenon in various media.
CO5	Analyze wave propagation characteristics and power transportation phenomenon.

II-Year-II Semester
PC2209

DIGITAL SYSTEM DESIGN WITH VHDL

L	T	P	C
3	0	2	3

Pre-Requisites: Digital Circuits and Logic Design

Course Objectives:

1. To understand various Digital Logic Families and their Interfacing
2. To know the basics of VHDL and programming models
3. To implement digital systems using VHDL
4. To design combinational circuits using VHDL code and relevant ICs
5. To design and implement sequential circuits using VHDL code and relevant ICs

UNIT-I: DIGITAL LOGIC FAMILIES 16 HOURS

Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behavior, CMOS logic families. Bipolar logic, Transistor-Transistor logic and TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic, Parameters to

choose logic families for the design applications.

UNIT-II: INTRODUCTION TO VHDL 13 HOURS

Introduction to HDL, design flow with VHDL, Program structure in VHDL. Levels of abstraction, VHDL elements: data types, data objects, operators and identifiers. VHDL programming models: data flow, structural and behavioral with examples on simple

combinational and sequential circuits.

UNIT-III: DIGITAL DESIGN USING VHDL 12 HOURS

Concurrent vs. Sequential statement, *Concurrent statements:* WHEN, GENERATE, BLOCK. Process: single and multiple, variable assignment vs signal assignment. *Sequential statements:* IF, WAIT, CASE, LOOP, NULL, EXIT, ASSERTION, CASE vs IF, CASE vs WHEN. Delay

Models: Inertial and Transport, Comparison of VHDL with other procedural languages.

UNIT–IV: COMBINATIONAL LOGIC IC DESIGN 12 HOURS

Adders: Ripple Carry, Carry Look ahead, Adder-Sub tractors, Multiplexers, Decoders/De-multiplexers, Encoders: Priority Encoders, Parity Checkers, ALU, Comparators, Design

considerations of these combinational circuits using VHDL code and relevant IC.

UNIT-V: SEQUENTIAL LOGIC IC DESIGN 13 HOURS

SSI Latches and Flip-flops, Shift Registers, Synchronous and Asynchronous Counters, Ring and Johnsons Counter, Sequence detector. Design considerations of these sequential circuits using VHDL code and relevant IC.

Introduction to PLDs: Overview of PLDs, CPLD: Introduction to CPLD, SPLD versus CPLD,

FPGA: Building Blocks, FPGA based Digital System Design Philosophy.

Text Books

1. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rdEd., 2005.
2. Circuit Design with VHDL - V. A. Pedroni, MIT Press, Cambridge, 2004.
3. VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.
4. Digital System Design with FPGA: Implementation using Verilog and VHDL - CemUnsalan, Bora Tar, McGraw Hill Education, 2017.

Reference Books

1. Fundamentals of Digital Logic with VHDL Design- Stephen Brown, ZvonkoVranesic,McGraw Hill, 3rd Edition, 2009.
2. Digital systems principles and Applications-Ronald J. Tocci, Neal S.Widmer, EighthEdition, Prentice Hall.
3. VHDL: Programming by Example- Douglas L. Perry, Fourth Edition, Tata McGraw-Hill.

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

CO1	Understanding the structural description and electrical characteristics of various digital logic families. **(Understand)**
CO2	Studying basics of HDL and Programming models of VHDL. **(Remember)**
CO3	Implementing digital systems using VHDL. **(Analyze)**
CO4	Implementing the Combinational logic using ICs and VHDL code. **(Analyze)**
CO5	Modeling of Sequential circuits using ICs and VHDL code. **(Apply)**

II-Year-II Semester **CONTROL SYSTEMS**

L	T	P	C
3	0	2	3

Pre-Requisites: Mathematics-1, Networks and Transmission Lines, Signals and Systems.

Course Objectives:

1. To introduce the concepts of open loop and closed loop systems, mathematical models ofmechanical and electrical systems, and concepts of feedback.
2. To study the characteristics of the given system in terms of the transfer function andintroducing various approaches to reduce the overall system for necessary analysis.
3. To develop the acquaintance in analyzing the system response in time-domain and frequencydomain in terms of various performance indices.
4. To analyze the system in terms of absolute stability and relative stability by differentapproaches.
5. To design different control systems for different applications as per given specifications. To introduce the concepts of state variable analysis, design and also the concepts of controllabilityand observability.

UNIT-I: 13 HOURS

Introduction: System Control System, Open Loop Control System, Closed loop Control System,Different Examples.

Effects of Feedback: Feedback Characteristics and its advantages, Linearizing effect offeedback.

Mathematical models of Physical Systems: Differential equations of physical systems, Transfer functions, Block diagram Algebra, Signal flow graphs with illustrative examples.

UNIT-II: 14 HOURS

Controller Components: DC Servomotor (Armature Controlled and Field Controlled) with necessary derivation for transfer function, AC Servomotor and its transfer function, AC Tachometer, Potentiometer, Synchros, AC Position Control Systems.

Time Response Analysis: Standard test Signals, Time response of first and second order systems, steady state errors and error constants, Effect of adding a zero to a system, Design specifications of second order systems, Performance indices.

UNIT-III: 12 HOURS

Concepts of Stability and Algebraic Criteria: The concept of Stability, Necessary Conditionsfor Stability, Routh-Hurwitz Srability Criterion, Relative stability analysis.

The Root Locus Technique: Introduction, The Root Locus concepts, Construction of Root Loci.

UNIT–IV: 12 HOURS

Frequency Response Analysis: Introduction, Correlation between time and frequency response, frequency domain specifications, Polar Plots, Bode Plots, Nyquist Stability Criterion.

UNIT-V: 14 HOURS

Introduction to Design: The design problem, Preliminary consideration of classical design, Realization of basic Compensators, Cascade compensation in time domain and frequency domain.

State Variable Analysis and Design: Introduction, Concepts of State, State Variables and State
models, State models for linear continuous-time systems, State variables and linear discrete-time systems, Solution of state equations and Concepts of Controllability and Observability.

Text Books

1. J. Nagrath and M. Gopal: Control System Engineering, New Age International Publishers,Fifth edition.
2. Katsuhiko Ogata: Modern Control Engineering, Pearson, Fifth Edition.
3. S. Salivahanan, R. Rengaraj, and G. R. Venkata Krishnan: Control Systems Engineering,"Pearson, First Impression.

Reference Books

1. Benjamin C. Kuo, Frarid Golnaraghi: Automatic Control Systems," Wiley Student Edition,Eighth Edition.
2. Padma Raju and Reddy: Instrumentation and Control Systems ", McGraw Hill Education,2016.

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

CO1	**Understand** the concepts of open loop and closed loop systems, mathematical modelsof mechanical and electrical systems, concepts of feedback, Construct the mathematical model of a system and Apply various approaches to reduce the overall system.
CO2	**Develop** the acquaintance in analyzing the system response in time-domain, in terms of various performance indices.
CO3	**Analyze** the system in terms of absolute stability and relative stability by different approaches.
CO4	**Develop** the acquaintance in analyzing the system response in frequency domain in terms of various performance indices.
CO5	**Design** the control systems for various applications using time-domain and frequency domain analysis as per given specifications. **Determine** the controllability and observability of the control system using the concepts of state variable analysis.

II-Year-II Semester OE2201	DATA STRUCTURES (Open Elective-1)	L	T	P	C
		3	0	0	3

Pre-Requisites: Prior knowledge of programming language(s) and fundamental mathematics

Course Objectives:

1. To impart the usage of linear list to students.
2. To help students understand the difference between dynamic memory using linked list.
3. To demonstrate the students about the operations Trees.
4. To make the student to understand various algorithms in graphs.
5. To make the students to learn the importance of hashing and sorting algorithms.

UNIT-I: ALGORITHMS AND LINEAR LISTS 10 HOURS Algorithmic complexity, performance and Analysis, Linear lists (Arrays) , Applications of LinearList : Searching and Sorting.
UNIT-II: STACKS AND QUEUES, LINKED LISTS 16 HOURS Single Linked List, Double Linked List, Circular Linked List, Stack and Queues using Linkedlist.
UNIT-III: TREES 14 HOURS Binary Trees Operations, Tree traversal, Threaded Binary Trees, Binary Search Trees, BinaryHeap
UNIT–IV: GRAPHS 10 HOURS Elementary Graph Operations, Graph Traversals, Minimum cost spanning tree Algorithms,Shortest paths algorithms.
UNIT-V: HASHING AND PATTERN MATCHING 10 HOURS Concept Hashing, Hash Functions, Collision Resolution Techniques, Pattern Matchingalgorithms.

Text Books
1. Data structures, Algorithms and Applications in Java, S. Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press, Pvt. Ltd. 2. Data structures and Algorithm Analysis in Java, Mark Allen Weiss, Pearson Education. Ltd, Second Edition.
Reference Books
1. Data Structures and Algorithms, A. V. Aho, J. E. Hopcroft, and J. D. Ullman, Pearson, 2002. 2. Introduction to Algorithms, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest,and Clifford Stein, MIT Press. 3rd Edition. 3. Classical Data Structures, 2nd Edition, Debasis Samanta, PHI.

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

CO1	**Understand** the implementation of linear lists**(Understand**
CO2	**Examine** static and dynamic data structures with suitable applications. **(Apply)**
CO3	**Determine** trees applications. **(Apply)**
CO4	Appreciate the importance and **significance** of graph algorithms in building and solving real world applications. **(Analyze)**
CO5	**Understand** and implement algorithms for text processing.**(Understand)**

II-Year-II Semester OE2201	MECHATRONICS (Open Elective-1)	L	T	P	C
		3	0	0	3

Pre-Requisites: Engineering mechanics and mechanics of materials

Course Objectives:

1. Understand key elements of Mechatronics system, representation into block diagram
2. Understand concept of transfer function, reduction and analysis
3. Understand principles of sensors, its characteristics, interfacing with microcontroller
4. Understand the system modeling and analysis in time domain and frequency domain
5. Understand control actions such as Proportional, derivative and integral and study its significance in industrial applications

Unit-I: Introduction to Mechatronics 10Hours

Definition of Mechatronics, Mechatronics in manufacturing, Products, and design. Comparison between Traditional and Mechatronics approach. Examples of Mechatronic systems, Electric circuits and components, Semiconductor Electronics, Transistor Applications.

Unit-II: Sensors and transducers 12 Hours

Performance terminology of sensors, Data conversion devices, Displacement, Position & Proximity Sensors, Force, Fluid pressure, Liquid flow sensors, temperature, light sensor, Acceleration and Vibration measurement, Semiconductor sensor and MEM, SAW

Unit-III: Actuators and mechanisms 16Hours

Mechanical Actuation System, Hydraulic Actuation System: Hydraulic elements, walls, actuators, and various other elements. Hydraulic powder packs, pumps. Pneumatic Actuation System: production, distribution and conditioning of compressed air, Electrical Actuation System, Data Presentation system

Unit-IV: Review of fundamental of Electronics 12Hours

Introduction to signal processing & Op-Amp, Op-Amp as signal conditioner, Analogue to Digital Converter, Digital to Analogue Converter, Digital circuits, Microprocessor Micro Controller, Programming of Microcontrollers, Artificial intelligence

Unit-V: Modeling and system response, closed loop controllers 10Hours

Mechanical system model, Electrical system model, Fluid system model, Dynamic response of systems, Transfer function and frequency response. P,I, PID Controllers, Digital Controllers, Program Logic Controllers, Input/output & Communication systems, Fault findings

Text Books

[1] Introduction to Mechatronics: D.G. Alciatore & Michael B. Histand; Tata Mc Graw Hill

[2] Mechatronic system Design; Shetty Dedas, Kolk and Richard

[3] HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi

[4] Mechatronics, Intl. J. Published by Pergamon Press

Reference Books

[1] Mechatronic handbook: Bishop; CRC press

[2]. Intelligent Mechatronic Systems: Modeling, Control and Diagnosis, R. Merzouki, A. K. Samantaray, P. M. Pathak, B. Ould Bouamama, Springer, London

[3] T.O. Boucher, Computer automation in manufacturing - an Introduction, Chappman and Hall

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

CO1	Identification of key elements of Mechatronics system and its representation
CO2	Understanding the concept of performance terminology of sensors
CO3	Analyze the Mechanical, hydraulic, and pneumatic actuation systems employ various elements like actuators and pumps,
CO4	Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O
CO5	Illustrate the Time and Frequency domain analysis of system model (for control application) and PID control implementation on real time systems

II-Year-II Semester OE2201	DBMS (Open Elective-1)	L	T	P	C
		3	0	0	3

Pre-Requisites: No prerequisite

Course Objectives:

1. Study the basic concepts and importance of Database Management Systems
2. Learn and understand the conceptual design of database and information retrieval
3. Learn various commands and writing of queries for information retrieval
4. Understand the concepts of Database design
5. Study of internal storage and its access

Unit-I: Introduction 10 Hours

Introduction to Database, Applications of Database, Purpose of Database, View of Data, Data Independence, Data Models, Users of Database, DBA, Query Processor, Storage Manager, Database Architecture

Unit-II: Conceptual Design & Relational Query Languages 10Hours

Conceptual Design of Database using ER Model, Notations, Types of attributes, Relation, Mapping Constraints, Features of ER Diagram, Weak Entity Set, Examples of Conceptual Design

Relational Algebra: Selection, Projection, Set Operations, Rename, Cartesian-Product, Join, Outer Join, Examples

Relational Calculus: Tuple Relational Calculus and Domain Relational Calculus, Safety Expressions

Unit-III: SQL & PL/SQL 12Hours

SQL Commands: DDL, DML, TCL, DCL

Types of Constraints (Primary, Alternate, Not Null, Check, Foreign), Basic form of SQL query, joins, outer joins, set operations, group operations, various types of queries, PL/SQL (Cursor, Procedures, Functions, Packages, Triggers…)

Unit-IV: Database Design 12 Hours

Database Design: Normalization, Purpose of Normalization, Functional Dependency, Closure, 1NF, 2NF, 3NF, BCNF, MVFD, 4NF, Join Dependency, 5NF Why NoSQL? Importance of NoSQL

Unit-V: Transaction, Data Recovery & Storage Management 16 Hours

Transaction Management: ACID Properties of Transactions, Conflict & View serializability, Lock based protocols, Time Stamp based protocol, Thomas Write Rule, Validation Based Protocol, Deadlock detection, Deadlock avoidance, Deadlock prevention: wait-die and wound-wait

Recovery Management: Types of failures, ideal storage, Log, Log records, log-based recovery techniques, Shadow Paging, ARIES

File Organization & Indexing: Types of File Organizations, Primary Indexing, Secondary Indexing, Multi-level Indexing, Hash Indexing, Tree Indexing

Text Books

1. Data base System Concepts,5/e, Silberschatz, Korth, TMH
2. Introduction to Database Systems, CJ Date, Pearson

Reference Books

1. Data base Management Systems, Raghu Rama Krishnan, Johannes Gehrke, and TATA McGraw Hill 3rd Edition
2. Fundamentals of Database Systems, ElmasriNavate Pearson Education

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

CO1	To comprehend the basics of database systems and applications
CO2	To construct logical design of database and information retrieval
CO3	To demonstrate relational model practically (Structured Query Language)
CO4	To demonstrate and relate normalization for database design
CO5	To outline the necessity of transaction management, recovery management, file organization & indexing

II YEAR II Semester
PC2211L

Analog Circuits Lab

L	T	P	C
0	0	3	1.5

Perform design experiments (from 1 to 8) using discrete components and perform design andsimulation experiments (from 9 to 11) using any PSPICE simulators or any equivalent software.

Course Objectives:

1. To learn the working of RC Circuit as differentiator and integrator
2. To Understand the operation of clipper and clampers circuits
3. To learn frequency response of common emitter, common source and two stage RC coupled amplifier
4. To learn the working of LC and RC oscillators.

List of Experiments: (Minimum of ten experiments to be done in bothhardware and software.)

1. Design and verify the operation of RC Circuit as differentiator and integrator.
2. Design and study the clipper circuits for the given specifications.
3. Study the operation of positive and negative clampers circuits.
4. Design common emitter amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response.
5. Design common source amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response.
6. Design a two stage RC coupled amplifier for given specifications. Determine Gain andBandwidth from its frequency response curve.
7. Design a RC Phase shift oscillator and Wien bridge oscillator for the given specification. Determine the frequency of oscillation.
8. Perform Hartley and Colpitts oscillators for the given specifications. Determine thefrequency of oscillation.
9. Determine Gain and Bandwidth from its frequency response curve of a darlingtonamplifier.
10. Perform voltage series feedback amplifier for the given

specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.

11. Perform single tuned amplifier for the given specifications.

Equipment/Software required:

1. Multisim software or any equivalent software
2. Personal computer system with necessary software to run the programs and Implement.
3. Regulated Power Suppliers, 0-30V
4. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
5. Functions Generators-Sine and Square wave signals
6. Multimeters
7. Electronic Components

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

CO1	Design and verify the operation of RC Circuit as differentiator and integrator.**(Create)**
CO2	Understand the operation of clipper and clampers circuits. **(Understand)**
CO3	Calculate the bandwidth of common emitter, common source and two stage RC coupled amplifier.**(Apply)**
CO4	Design LC and RC oscillators. **(Create)**
CO5	Compare gain and bandwidth of amplifier with and without feedback. **(Analyze)**

II- Year II Semester

PC2202L **DIGITAL SYSTEM DESIGN WITH VHDL LAB**

L	T	P	C
0	0	3	1.5

The students are required to design and draw the logical structure of the following Digital Circuits (relevant ICs wherever mentioned) and write VHDL code to perform simulation and synthesis.

Course Objectives:

1. To understand the basics of HDL to design logic gates.
2. To learn to design combinational circuits using VHDL.
3. To learn to design sequential circuits using VHDL.

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Realization of Logic Gates using dataflow model
2. Design of Full Adder using dataflow, behavioral and structural (using logic gates and alsowith half adder) modeling.
3. Implement the VHDL code of 74x138 -- 3 to 8 Decoder.
4. Implement the VHDL code of Priority Encoder.
5. Design 8 x 1 Multiplexer using structural modeling by instantiating 4 x 1 Multiplexer(with enable input).
6. Design a 4- bit comparator using VHDL.
7. Design of 4-bit ALU using VHDL.
8. Implementation of SR, JK, D and T- flip-flops using behavioral model.
9. Design of 8-bit serial in-parallel out and parallel in-serial out shift register.
10. Design of Universal Shift Register.
11. Design of Synchronous Decade counter.
12. Design of Ring and Johnsons counter.
13. Design of Sequence detector.
14. Design of Vending Machine.

Note: **Perform all above experiments related to real time examples**

Equipment/Software required:

1. Relevant software
2. Personal computer system with necessary software to run the programs and Implement.

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

CO1	**Understand** the basics of HDL and Apply different programming approaches for obtaining digital Logic Gates and full adder, Perform simulation and verify the logical operations and also analyze the synthesis result.**(Understand)**
CO2	**Apply** programming approach using VHDL for developing decoder, encoder and multiplexer, Perform simulation and verify the logical operations and also analyze the synthesis result.**(Apply)**
CO3	**Write** VHDL Source code for higher order **comparator and ALU,** Perform simulation and verify the logical operations and also analyze the synthesis result.**(Create)**
CO4	**Use** VHDL programming approach for developing Flip Flops, registers and shift register circuits, Perform simulation and verify the logical operations and also analyze the synthesis result. **(Apply)**
CO5	**Design different** Counters and shift register counters using VHDL Source code, Perform simulation and verify the logical operations and also analyze the synthesis result. **(Create)**

II-Year-II Semester
SC2202

Open Source Hardwar Tools for Electronic Engineers

L	T	P	C
1	0	2	2

Pre-Requisites: Knowledge of electronics components

Preamble: "Open hardware," or "open source hardware," refers to the design specifications of a physical object which are licensed in such a way that said object can be studied, modified, created, and distributed by anyone. Like open source software, the "source code" for open hardware—schematics, blueprints, logic designs, Computer Aided Design (CAD) drawings or files, etc.—is available for modification or enhancement by anyone under permissive licenses. Users with access to the tools that can read and manipulate these source files can update and improve the code that underlies the physical device. They can even modify the physical design ofthe object itself and, if they wish, proceed to share such modifications.

Course Objectives:

1.To introduce open-source hardware platforms to the students

2.To design and develop general purpose electronic systems

3.To introduce electronic system coding, testing and debugging tools

4.To interface different analog and digital sensors which are basic building blocks for anyinteractive system design.

5.To familiarize student with the basic PCB designing concepts.

UNIT-1: INTRODUCTION TO OPEN-SOURCE TOOLS

Embedded systems, microprocessors and microcontrollers, What is open-source, why open- source, advantages of open-source tools, open-source hardware development platforms – Arduino, Raspberry Pi and Beagle bone.

UNIT-II: INTRODUCTION TO ARDUINO

Introduction to Arduino , Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, Introduction to Embedded C and Arduino platform

UNIT-III: PROGRAMMING ARDUINO BOARDS
Arduino data types, Variables and constants, Operators, Control Statements, Arrays, Functions, PinsConfigured as INPUT, Pull-up Resistors, Pins Configured as OUTPUT, pinMode() Function, digitalWrite() Function, analogRead() function.
UNIT-IV: INTERFACING SENSORS WITH ARDUINO
Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor, Connecting Switch (Magnetic relay switches), buzzers, LEDs and LCD.
UNIT-V: INTRODUCTION TO PCB DESIGNING CONCEPTS
Introduction & history: Types, PCB materials, Trends in designing, Component packaging types.PCB designing flow chart, Description of PCB layers, study of IPC standards.

Hardware: Arduino UNO, NANO, MEGA2560. Software's used: Arduino IDE
For PCB designing: PCB Web Designer, Zenit PCB, Tiny CAD, Osmond PCB, BSch3V, Express PCB, Kicad, Fritzing, Design Spark PCB, Easy EDA.

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

CO1	Understand the open-source hardware platforms.
CO2	Familiarize electronic system coding, testing and debugging tools
CO3	Design and develop general purpose electronic systems using Arduino.
CO4	Understand the interfacing of Sensors.
CO5	Understand the basics of PCB designing concepts

III-Year-I Semester PC3112	LINEAR IC APPLICATIONS	L	T	P	C
		3	0	0	3

Pre-Requisites: Network Analysis & Basic Electronics.

Course Objectives:

1. To understand the basic operation and performance parameters of differential amplifier and operational amplifier.
2. To learn the Linear and non-linear applications of operational amplifier.
3. To understand the analysis & design of different types of active filters using Op-Amps.
4. To learn the internal structure, operation and applications of different analog
5. To understand the various types of Digital to Analog and Analog to Digital converters

UNIT-I: 16 HOURS

Differential Amplifier and Operational Amplifier Characteristics: Internal Block Diagramof various stages of Op-Amp and Roll of each Stage. Different configurations of differential amplifiers (Qualitative), DC & AC Analysis of Differential Amplifier using BJT, Basic Current mirror circuit using BJT, Current Repeater Circuits using BJT. Improved version of current mirror, Wilson current mirror.

Operational Amplifier (Symbolic Representation), Characteristics of Op-Amp, Ideal and Practical Op-Amp specifications, DC&AC characteristics of operational Amplifier: input bias current, input offset current, input offset voltage, Drift, Slew rate, CMRR, PSRR, Measurementsof Op-Amp Parameters, pin diagram of IC 741. Equivalent diagram of operational amplifier. Three-Terminal Voltage Regulators 78xx& 79xx Series, IC 723 general purpose voltage regulator

UNIT-II: 11 HOURS

Linear and Non-Linear applications of Operational Amplifier:

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

Square wave generators, Schmitt trigger.

UNIT-III: 10 HOURS

Active Filters, Analog Multipliers, Oscillators and Modulators: Design & Analysis of Butterworth active filters 1st order, 2nd order LPF, HPF filters. Bandpass, Band reject and allpass filters. Four Quadrant Multiplier, IC 1496, Sample & Hold circuits.

Introduction to Oscillators, RC Phase shift oscillator, Wien Bridge Oscillator.

UNIT–IV: 12 HOURS

Timers & Phase Locked Loops: Introduction to 555 timer, functional diagram, Monostable andAstable operations and applications, Schmitt Trigger.

PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL,

Applications of PLL frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566).

UNIT-V: 11 HOURS

Data Converters and its applications:

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 typeADC, Successive approximation ADC and Dual slope ADC.. DAC and ADC Specifications

(including DNL and INL)

Text Books

1. Linear Integrated Circuits D. Roy Choudhury, New Age International (p) Ltd, 2ndEdition,2003.
2. Op-Amps& Linear ICs-Ramakanth.A, Gayakwad,PHI,1987
3. Design with Operational Amplifiers & Analog Integrated Circuits Sergio

Franco,McGraw Hill, 1988.

Reference Books

1. Operational Amplifiers & Linear Integrated Circuits Sanjay Sharma;SK Kataria&Sons;2nd Edition,2010
2. Operational Amplifier & Linear IC R.FCoughlin & Fredrick Driscoll PHI 6th edition ,2000
3. Linear Integrated Circuits by Salivahan-3rd-Edition, McGrawHill,2018.
4. Operational Amplifiers & Linear ICs David A Bell, Oxford Uni. Press, 3rd Edition,2011.

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

CO1	**Understand** the DC and AC analysis of Differential Amplifier, and performance parameters of OP-Amp and its characteristics
CO2	**Illustrate** the linear and nonlinear applications using op-amp.
CO3	**Analyze** and Design active filters, Modulators and oscillators using Op-Amp
CO4	**Interpret** the internal structure and operations of different analog circuits
CO5	**Construct** the various Digital to Analog and Analog to Digital Converters

III-Year-I Semester HS3104	Engineering Economics and Management	L	T	P	C
		3	0	0	3

Pre-Requisites: Basic Sciences and Humanities

Course Objectives:

1. To understand the concept and nature of Economics and Demand and to familiarize about the Production function, Input Output relationship, Cost-Output relationship and Break EvenAnalysis.
2. To understand the nature of markets and the concepts of Money and RBI functions.
3. To familiarize with the process of management, principles, and to provide conceptual knowledge on functional management that is on Human resource management and Marketing management.
4. To learn different Accounting Systems, preparation of Financial Statement and to familiarize with the tools of project Management.
5. To understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

UNIT-I

Introduction to Economics and Theory of Production 13 HOURS Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics –Concept of Demand, Types of Demand, Determinants of Demand-Law of Demand -Elasticity of Demand, Types of Elasticity of Demand.

Theory of production; production function, Law of variable proportions & law of returns to scale, Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, simple problems.

UNIT-II

Introduction to Markets and Money 12 HOURS Markets: meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly). National Income, GNP, GDP, NNP, NDP, Personal income and GST (Goods & Service Tax).

Money: meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-

meaning, objectives, tools, Banking; meaning, types, functions, Central Bank-RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.

UNIT-III

Introduction to Management 12 HOURS

Concept –nature and importance of Management Functions of Management, Principles ofManagement.

Human Resource Management: Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management.

Marketing Management: Functions of Marketing - Marketing strategies based on product LifeCycle, Channels of distributions.

UNIT–IV:

Introduction to Accounting & Project Management 15 HOURS Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of FinalAccounts with adjustments – Preparation of Financial Statements.

Project Management: (PERT/CPM): Development of Network – Difference between PERT and
CPM Identifying Critical Path (Simple Problems).

UNIT-V:

Capital and Capital Budgeting: 12 HOURS

Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value
method, Internal Rate of Return Method and Profitability Index).

Text Books

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2018, 2e.
2. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis',Cengage Publications, New Delhi – 2012.
3. Management Science, Aryasri, Tata McGraw Hill, 2014.
4. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Introduction to Management Science'Cengage, Delhi, 2012.
5. Engineering Economy and Management 1 Edition Pravin Kumar – Wiley Publication.
6. Engineering Economics & Management- Dr. Vilas Kulkarni &

HardikBavishi - VikasPublishing

Reference Books

1. R. L Varshney, K.L. Maheshwari : Managerial Economics, Sultan Chand&Sons2014,22e.
2. Suma Damodaran : Managerial Economics, Oxford 2010,2e.
3. Ambrish Gupta: 'Financial Accounting for Management', Pearson 2015,5e.
4. Dr. S.N. Maheswari: Financial Accounting, Vikas Publications 2018.
5. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New AgeInternational Publishers, 2017.
6. Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshan ul Haque , 17th Edition, Pearson Education/ Prentice Hall of India, 2018.
7. Human Resource Management: Gary Dessler, 14th Edition, pearson 2015.
8. Project Planning and Control with PERT and CPM: Dr. B. C. Punmia, K. K Khandelwal, Laxmi Publication, 2017, 4th Edition.

1. www.managementstudyguide.com
2. www.tutorialspoint.com
3. www.lecturenotes.in

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

CO1	The Learner is equipped with the knowledge of estimating the Demand and demand elasticity's for a product and Input-Output-Cost relationships.
CO2	The Learner is also ready to understand the nature of different markets and also to have the knowledge of Money & Banking.
CO3	The Learner will acquire the knowledge on management, HRM and Marketing.
CO4	The Learner will acquire the knowledge to prepare Financial Statements and thetechniques of project management.
CO5	The Learner can able to evaluate various investment project proposals with the help ofcapital budgeting techniques for decision making.

III-Year-I Semester PC3113	ANALOG AND DIGITAL COMMUNICATIONS	L	T	P	C
		3	0	0	3

Pre-Requisites: Signals& Systems, Random Variables and Stochastic Process

Course Objectives:

1. Familiarize with the fundamentals of analog communication systems with various amplitude modulation and distinguish their noise performances
2. Familiarize with the fundamentals of analog communication systems with various angle modulation techniques and distinguish their noise performances. Develop the ability to classify and understand various functional blocks of radio receivers.
3. Understand different pulse digital modulation techniques and their comparison
4. Familiarize various digital modulation techniques and calculation of their error probabilities
5. Understand the concept of entropy and different source coding techniques

UNIT-1

AMPLITUDE MODULATION

Introduction to the communication system, Need for modulation, Amplitude Modulation: Single tone modulation, Generation of AM waves - Square law modulator, Switching modulator; Detection of AM Waves - Square law detector, Envelope detector. Generation of DSBSC Waves - Balanced Modulators, Ring Modulator; Demodulation of DSBSC waves. Generation of SSBSC Waves - Frequency discrimination method, Phase discrimination method; Demodulation of SSBSC Waves. Vestigial sideband modulation, Generation of VSB Modulated wave, Comparison of AM Techniques- Power & BW, Radio Receiver: Receiver

Types - Tuned radio frequency receiver, Superheterodyne receiver. AM receivers.

UNIT-II

ANGLE MODULATION

Basic concepts, Frequency Modulation – Single-tone frequency modulation, Spectrum, Analysis of Sinusoidal FM Wave, Narrow band FM, Wideband FM; Generation of FM Waves

- Direct FM, Indirect FM. Detection of FM Waves – Foster-Seeley Discriminator, PLL; Superheterodyne FM receiver; Noise in SSBSC& DSBSC Systems, Noise in AM System, Noise in Angle Modulation

Systems, Comparison of AM and FM Systems.

UNIT-III

PULSE DIGITAL MODULATION

Overview of Pulse Analog Modulation techniques, Elements of digital communication systems, Advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Encoding. Companding in PCM systems, Differential PCM, Delta modulation and Adaptive delta modulation. Noise in PCM and DM systems, Comparison of PCM and DM

systems.

UNIT-IV

DIGITAL MODULATION TECHNIQUES

Introduction, Binary schemes: Generation and Demodulation of ASK, FSK, PSK,DPSK; M- ary schemes; Data Transmission - Base band signal receiver, Probability of error, Matched filter, Calculation of error probability of BASK,BPSK, BFSK, QPSK schemes.

UNIT-V
INFORMATION THEORY

Discrete messages, concept of amount of information and its properties. Average information: Entropy and its properties. Information rate, Mutual information, and its properties. Source Coding - Introduction, Advantages, Shannon's theorem, Shannon-Fano coding, Huffman coding, Efficiency calculations, Channel capacity of discrete and analog Channels, Capacity of a Gaussian channel, Bandwidth –S/Ntrade off.

Text Books

1. S. Haykin, Communication Systems (4/e), Wiley, 2001.
2. Taub, Herbert and Donald L. Schilling, Principles of Communication Systems. TataMcGraw-Hill Education, 2008.

3. B. P. Lathi, Modern Digital and Analog Communications Systems, (3/e), OxfordUniversity Press, 1998.

Reference Books

1. J.G. Proakis, Digital Communication (4/e), McGraw – Hill, 2001.
2. B. Sklar, Digital Communications: Fundamentals & Applications, Pearson Education,(2/e), 2001.
3. HweiHsu,Analog and Digital Communications, (2/e),Schaum's Outlines.
4. R.E. Zimer & R.L. Peterson, Introduction to Digital Communication, PHI, 2001.
5. Data books to be allowed in examinations: Table of Bessel Function, Table of Errorfunction / Q-function

e- Resources & other digital material:

Lecture Series on Communication Engineering by Prof. Surendra Prasad, Department of Electrical

Engineering, IIT-Delhi.
https://www.youtube.com/playlist?list=PL7748E9BEC4ED83CA

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

CO1	Distinguish various Amplitude modulation and demodulation schemes and Understand various functional blocks of AM radio receivers.(Analyzing)
CO2	Distinguish various Angle modulation and demodulation schemes and Compare the performance of AM, FM and PM schemes with reference to SNR.(Analyzing)
CO3	Describe the generation and detection of base band system and Determine the performance of line codes in terms of mitigating inter symbol interference.(Evaluating)
CO4	Determine the probability of error for various digital modulation scheme (Evaluating)
CO5	Analyze the performance of different error control coding schemes for the reliabletransmission of digital representation of signals and information over the channel.(Analyzing)

III Year I Semester

PC3114 **VLSI DESIGN**

L	T	P	C
3	0	0	3

Pre-Requisites: Digital circuits and logic design and DSD DICA

Course Objectives:

1. Apply the electrical properties of CMOS and BiCMOS circuits to understand design concepts and processes
2. Familiarize with the basic circuit concepts to determine circuit delays, and also to utilize scaling of MOS circuits for miniaturization.
3. Interpret the CMOS static features to design digital circuits.
4. Understand the CMOS dynamic analytical aspects to design combinational and sequential circuits.
5. Build a strong knowledge on the fundamentals of FPGA design structures and their applications.

UNIT-I

IC Technology: VLSI Design Flow, Introduction to IC Technology, Basic MOS transistors, Fabrication Process of NMOS, PMOS and CMOS, Introduction to BiCMOS Technology, Comparison between CMOS and Bipolar technologies.

Basic Electrical Properties: I_{ds} vs. V_{ds} relationships, Aspects of MOS transistor Threshold voltage, MOS transistor transconductance and output conductance, figure of merit, The Pass transistor, The NMOS Inverter, Determination of pull up to pull down ratio for NMOS inverter driven by another NMOS inverter directly or through one or more pass transistors, Alternative forms of pull ups, The CMOS Inverter, BiCMOS Inverter, Latch-up in CMOS circuits, MOS Layers, Stick diagrams, Layout Encoding and Design Rules, Stick Diagram and Layout DiagramsExamples.

UNIT-II

Basic Concepts: Sheet resistance, Sheet resistance concept applied to MOS transistors and Inverters, Area Capacitance of layers , Standard unit of capacitance, some area capacitance calculations, The Delay unit, Inverter delays, Driving large Capacitive Loads, Propagation delays, wiring capacitances, Choice of layers.

Scaling: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of

scaling, Limits due to subthreshold currents, Limits due to current density.

UNIT-III

Static CMOS Design: Complementary CMOS: Propagation Delay, Voltage Transfer Characteristics, Power Consumption. Ratioed Logic: Basic Concept, Effect of decrease in Wp, Differential Cascode Voltage Switch Logic (DCVSL). Pass-Transistor Logic: Design of Logic Gates, Transmission Gate.

UNIT-IV

Dynamic CMOS Design: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, Choosing a Logic Style, Latch Versus Register, multiplexer based latches, Master-Slave Based Edge Triggered Register, Dynamic Transmission-Gate edge-triggered register, setup time, hold time, Clocked CMOS register.

UNIT-V

Introduction to PLDs: Overview of PLDs, CPLD: Introduction to CPLD, Example of CPLD: Xilinx CoolRunner, FPGA: Introduction to FPGA, Organization of FPGA, Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects and I/O Blocks.

Text Books

1. D. A. Pucknell and K. Eshraghian, Basic VLSI Design, (3/e), PHI Learning Pvt. Ltd.,2009.
2. J. M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits, (2/e), 2003.
3. C. H. Roth, L. K. John and B. K. Lee, Digital Systems Design using Verilog, CengageLearning, 2016.

Reference Books

1. K. Eshraghian, D. A. Pucknell and S. Eshraghian, Essentials of VLSI Circuits andSystems, Prentice-Hall of India Private Limited, 2005.
2. M. D. Ciletti, Advanced Digital Design with the Verilog HDL, Eastern Economy Edition,PHI, 2004.
3. A. Pang and P. Membrey, Beginning FPGA: Programming Metal: Your Brain onHardware, APress, 2017.
4. W. Wolf, FPGA-based System Design, Prentice Hall Modern Semiconductor DesignSeries, 2004.

NPTEL Lecture material

1. Lecture Series on VLSI Design by Dr.Nandita Dasgupta, Department of Electrical Engineering, IIT Madras. https://freevideolectures.com/course/2328/vlsi-technology/32
2. Lecture Series on Digital VLSI System Design by Prof. S. Srinivasan, Department of ElectricalEngineering, IIT Madras.

   http://www.nptelvideos.in/2012/12/digital-vlsi-system-design.html

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

CO1	**Apply** the basic electrical characteristics of MOS circuits to understand design concepts and processes. **{Applying level, KL3}**
CO2	**Demonstrate** the application of the basic concepts of MOS devices to determine the delays of the circuits and their miniaturization. **{Understanding level, KL2}**
CO3	Elaborate the operation of MOS circuits to design the single-stage amplifiers **{Creating level, KL6}**
CO4	**Analyze** the static and dynamic CMOS design aspects to develop combinational and sequential circuits **{Analyzing level, KL4}**
CO5	**Understand** the architectural aspects of CPLD and FPGA, and several advanced technologies. **{Understanding level, KL2}**

III- Year-I Semester **OOPS THROUGH JAVA**
OE3102 **Open Elective -2**

L	T	P	C
3	0	0	3

Pre-Requisites: Basic Programming Language of C

Course Objectives:

1. To identify Java language components and how they work together in applications
2. To learn the fundamentals of object-oriented programming in Java, including defining classes,invoking methods, using class libraries.
3. To learn how to extend Java classes with inheritance and dynamic binding and how to useexception handling in Java applications
4. To understand how to design applications with threads in Java
5. To understand how to use Java APIs for program development

Unit I: Introduction to OOPS Concepts, Arrays

Differences b/w C and Java, History Java, Introduction to Object Oriented Programming, Java Programming Basics, Data types and operators, Control statements.

Arrays: One Dimensional and multi-dimensional arrays, Searching, Sorting, Command-linearguments

Unit II: Classes& Inheritance, Interfaces, Packages

Classes: Classes, Objects, Methods, Constructors, this and static keywords, Method andConstructor Overloading, This Access modifiers

Inheritance: Single, Multi-level, hierarchical, Usage of Super, Method overriding, Final keyword,

Abstract class, Interfaces, Packages

Unit III: Exception Handling & Stream I/O

Exception Handling: Exception, Keywords- try, catch, throw, throws and finally.

Stream I/O: Byte streams and Character streams, Reading data from files and writing data to files,Random access file operations.

Unit IV: Multithreading & Applet Multithreading: Concepts of Multithreading, differences between process and thread, thread life Cycle, creating threads using Runnable interface, Thread class, Synchronization. Applet: Applet life cycle and its methods, Creation and execution of an Applet, passingparameters to an Applet
Unit V: GUI Programming and Event Handling GUI Programming: Difference b/w AWT & Swing, AWT & Swing components- Buttons, Check boxes, Radio buttons, Choice buttons, Labels, Text Fields. Event Handling: event delegation model, sources of event, Event Listeners, adapterclasses

Text Books
1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford. 2. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
Reference Books
1. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson 2. Murach's Java Programming, Joel Murach
e- Resources & other digital material **https://nptel.ac.in/courses/106/105/106105191/** **https://www.w3schools.com/java/java_data_types.asp**

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

CO1	Able to realize the concept of Object-Oriented Programming & Java Programming, Arrays
CO2	Able to describe the basic concepts of Java such as operators, classes, objects, inheritance,packages, Enumeration and various keywords
CO3	Apply the concept of exception handling and Input/ Output operations
CO4	Able to design the applications of Java & Java applet
CO5	Able to Analyze & Design the concept of Event Handling and Abstract Window Toolkit

III- Year-I Semester **Embedded C**
OE3102 **Open Elective -2**

L	T	P	C
3	0	0	3

Pre-Requisites: Basic Programming Language of C

Course Objectives:

1. Perform effectively as entry level Embedded Systems professionals.
2. Develop and maintain applications written using Embedded C.
3. Independently design and develop a hardware platform encompassing a microcontroller and peripherals

UNIT-I: Programming embedded systems in C 10Hours

Introduction, embedded system, processor, programming language, operating system, embedded software

UNIT-II: 8051 microcontroller 14 Hours

Introduction, external interface of the Standard 8051, Clock frequency and performance, Memory issues, I/O pins, Timers, Interrupts, Serial interface, Power consumption

UNIT-III: Reading switches 14 Hours

Introduction, Basic techniques for reading from port pins, Example: Reading and writing bytes, Reading and writing bits, pull-up resistors, switch bounce, Example: Reading switch inputs, counting goats.

UNIT-IV: Meeting real-time constraints 12 Hours

Introduction, hardware delays using Timer 0 and Timer 1, timeout mechanisms, loop timeouts, hardware timeouts, Example: Testing loop timeouts, Testing a hardware timeout

UNIT-V: Serial interface 10 Hours

Introduction, RS-232, basic RS-232 protocol, Asynchronous data transmission and baud rates, Flow control, on-chip UART, Memory requirements, Serial-Menu architecture, Example: Data acquisition, Remote-control robot

Text Books

1. Michael J. Pont, Embedded C, Pearson Education
2. Michael Barr, Programming Embedded Systems In C And C++, O'Rielly

Reference Books

1. Richard Barnett, Sarah Cox, Larry O'Cull, Embedded C Programming and the Microchip Pic, Delmar Cengage Learning
2. Ashok K. Pathak, Advanced Test in C and Embedded System Programming, BPB Publications

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

CO1	Understand the introduction to embedded systems
CO2	Demonstrate the concept of 8051 Microcontroller
CO3	Use the port pins for reading and writing bytes and bits
CO4	Implement hardware delays via Timer 0 and Timer 1
CO5	Explore serial interface using RS-232 communication with basic protocol

III- Year-I Semester **Total Quality Management**
OE3102 **Open Elective -2**

L	T	P	C
3	0	0	3

Course Objectives:

1. To learn the basic concepts of quality and quality from organizational point of view.
2. To learn the concept of organizing for total quality management approach.
3. To learn the internal politics, quality culture, education and training of the organization.
4. To be aware of international/national Quality standards.

UNIT – I: 12 Hours

Introduction, The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling

UNIT -II Customer Focus and Satisfaction: 12 Hours

Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing

UNIT- III Organizing for TQM: 12 Hours

The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, paneto diagram, Kepner & Tregoe Methodology.

UNIT- IV The Cost of Quality: 12 Hours

Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management

UNIT -V ISO9000: 12 Hours

Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third-party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

Text Books

1. Total Quality Management / Joel E. Ross/Taylor and Franscis Limited
2. Total Quality Management/P. N. Mukherjee/PHI

Reference Books

1. Total Quality Management: A Practical Approach/H. Lal
2. Quality Management/Kanishka Bedi/Oxford University Press/2011
3. Total Engineering Quality Management/Sunil Sharma/Macmillan

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

CO1	Understand the Quality environment of the organization
CO2	Demonstrate the concept of marketing for customer satisfaction
CO3	Use the various tools and circles organizing for TQM implementation
CO4	Infer the cost of quality refers to the total expenses associated with maintaining and improving product or service quality
CO5	Illustrate the international/national Quality standards

III- Year-I Semester DISASTER MANAGEMENT
OE3102 Open Elective -2

L	T	P	C
3	0	0	3

Course Objectives:

1. To provide basic conceptual understanding of disasters.
2. To understand approaches of Disaster Management.
3. To build skills to respond to disaster.

Unit: I 12 Hours

Systems of earth: Lithosphere- composition, rocks, soils; Atmosphere-layers, ozone layer, greenhouse effect, weather, cyclones, atmospheric circulations, Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere

Definition and meaning of key terms in Disaster Risk Reduction and Management: disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counseling, needs assessment

Unit: II Types, Trends, Causes, Consequences and Control of Disasters 12 Hours

Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters

Unit: III Disaster Management Cycle and Framework 12 Hours

Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre

– Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR,Yokohama Stretegy, Hyogo Framework of Action

Unit: IV Disaster Management in India 12 Hours

Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter Governmental Agencies

Unit: V Applications of Science and Technology for Disaster Management 12 Hours

Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India

Text Books

1. Gupta A.K., Niar S.S and Chatterjee S. Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
2. Murthy D.B.N. Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
3. Modh S. Managing Natural Disasters, Mac Millan publishers India LTD.

Reference Books

1. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill Education (India) Pvt. Ltd.
2. Jagbir Singh, Disaster Management: Future Challenges and Opportunities, K W Publishers Pvt. Ltd.
3. C. K. Rajan, Navale Pandharinath, Earth and Atmospheric Disaster Management: Nature and Manmade, B S Publication /Macmillan

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

CO1	Understand the Earth's systems and key terms of Disaster Risk Reduction and Management
CO2	Demonstrate the Hazards and disasters encompass a range of natural and human-induced events
CO3	Illustrate the Disaster Management Cycle
CO4	Infer the India's disaster profile
CO5	Use the Geo-informatics aids disaster management through tools

III Year I Semester

PC3115L **LINEAR IC APPLICATIONS LAB**

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To understand the basic operations of Operational Amplifier.
2. To observe the frequency response of Active Filters.
3. To understand Waveform Generators using Operational Amplifier and 555 Timer & Investigate different Voltage Regulators IC's
4. To learn Analog –Digital Converters and Digital – Analog Converters.

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Study of OP AMPs IC 741, IC 555, IC 565, IC 566, IC 1496 functioning, parameters andSpecifications
2. Design an inverting adder, non-inverting adder, subtracter and comparator using operationalamplifier.
3. Design an integrator and differentiator circuit using IC 741.
4. Design first order low pass and high pass filters using IC 741.
5. Design RC phase shift and Wein Bridge oscillators using operational amplifier.
6. Design a function generator to generate square and triangular waveforms.
7. Design a Monostable Multivibrator using IC 555.
8. Design an Astable Multivibrator using IC 555.
9. Design Schmitt trigger using IC 741.
10. Design & Construct a low voltage IC regulator (Using IC 723)
11. Perform the line regulation and load regulation of three terminal voltage regulators (7805,7809 and 7912).
12. Perform Phase locked Loop (IC 565) and measure lock range and capture range
13. Design a 4-bit D to A Converter using op amp.
14. Perform half wave precision rectifier using IC 741.

Note: **Perform all above experiments related to real time examples**

Equipment/Software required:

1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. IC Trainer Kits (Optional)
6. Bread Boards
7. Components: - IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912 and other essentialcomponents.
8. Analog IC Tester

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

CO1	**Understand** the basic Mathematical operations of Operational Amplifier. **(Understand)**
CO2	**Design** and Observe the frequency response of Active Filters. **(Create)**
CO3	**Measure** the theoretical and practical frequency of oscillators using Operational Amplifier. (**Evaluate**)
CO4	**Construct** different Waveform Generators using Operational Amplifier and 555 Timer & Investigate different Voltage Regulators IC's. (**Analyze**)
CO5	**Develop** different Analog –Digital Converters and Digital – Analog Converters. **(Create)**

III Year I Semester

PC31167 **VLSI DESIGN LAB**

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To Remember basics of HDL and Programing models of VHDL
2. To simulate VHDL source code for various combinational circuits.
3. To verify the VHDL source code of various circuits using FPGA.
4. To learn Mentor Graphics to simulate schematic and layouts of various circuits.

LIST OF EXPERIMENTS:

PART (A): FPGA Level Implementation (Any Seven Experiments)

Note 1: The students need to develop VHDL Source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary Synthesizer.

Note 2: All the experiments need to be implemented on the latest FPGA Hardware in theLaboratory

1. Realization of Logic gates

Design and Implementation of the following:

1. 4-bit ripple carry and carry look ahead adder using behavioural, dataflow andstructural modeling
   a) 16:1 mux through 4:1 mux b) 3:8 decoder realization through 2:4 decoder
2. 8:3 encoder
3. 8-bit parity generator and checker
4. J-K and T Flip-Flops
5. 8-bit synchronous up-down counter
6. 4-bit sequence detector through Mealy and Moore state machines.

EDA Tools/Hardware Required:

1. EDA Tool that supports FPGA programming including Xilinx Vivado tool along with corresponding FPGA hardware.
2. Desktop computer with appropriate Operating System that

supports the EDA tools.

PART (B): Back-end Level Design and Implementation (Any Five Experiments)

Note: The students need to design the following experiments at schematic level using CMOS logic and verify the functionality. Further students need to draw the corresponding layout and verify the functionality including parasites. Available state of the art technology libraries can be used while simulating the designs using Industry standard EDA Tools.

Design and Implementation of the following

1. Universal Gates
2. An Inverter
3. Full Adder
4. Full Subtractor
5. Decoder
6. D-Flip-flop

EDA Tools/Hardware Required:

1. Mentor Graphics Software Tool.
2. Desktop computer with appropriate Operating System that supports the EDA tools.

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

CO1	**Demonstrate** basics of HDL and Programing models of VHDL. **(Understand)**
CO2	**Develop** VHDL source code for various combinational circuits & **Verify** the simulation results. **(Apply & Evaluate)**
CO3	**Develop** VHDL code for digital circuits, synthesize and **Verify** the results using FPGA hardware. **(Apply & Evaluate)**
CO4	**Design** a schematic and layout of logic gates and **Analyse** the characteristics using mentor graphics. **(Apply & Analyse)**
CO5	**Design** and simulate list of combinational and sequential circuits using CMOS logic. **(Apply & Analyze)**

III Year I Semester PC3117L	ANALOG AND DIGITAL COMMUNICATIONS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

1.To Learn different Analog modulation & demodulation techniques

2.To Understand various pulse analog modulation techniques.

3.To learn MATLAB programming to implement various analog and Digital modulation techniques.

4.To learn MATLAB Simulink models to implement various analog & digital modulation techniques.

LIST OF EXPERIMENTS:

List of Experiments: (Minimum of Ten Experiments has to be performed)

Using MATLAB

1. AM Modulation and Demodulation
2. FM Modulation and Demodulation
3. Sampling Theorem Verification
4. FSK Generation and Detection
5. PSK Generation and Detection
6. Binary Amplitude shift keying and BER calculation

Using Simulink

7. AM Modulation and Demodulation
8. DSBSC Modulation and Demodulation
9. FM Modulation
10. Pulse Amplitude Modulation and Demodulation
11. SSBSC Modulation and Demodulation
12. PSK Generation and Detection

Using Hardware

13. AM Modulation and Demodulation
14. FM Modulation
15. Sampling Theorem Verification
16. Pulse Code Modulation
17. PSK Generation and Detection
18. Delta Modulation

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

CO1	**Analyze** different Analog modulation & demodulation techniques (**Analyze**)
CO2	**Understand** various pulse analog modulation techniques.(**Understand)**
CO3	**Demonstrate** various band pass digital modulation techniques. (**Apply)**
CO4	**Execute** programs in MATLAB to implement various analog and Digital modulation techniques. (**Apply)**
CO5	**Construct** MATLAB Simulink models to implement various analog & digital modulation techniques. **(Create)**

III-Year-I Semester
MC3103

ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

OBJECTIVE:

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

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies

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

UNIT – II: Ecosystems, Biodiversity, and its Conservation

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession

Food chains, food webs and ecological pyramids – Introduction, types, characteristic features,structure and function of the following ecosystem:

Forest ecosystem.

Grassland ecosystem

Desert ecosystem

Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) BIODIVERSITY AND ITS CONSERVATION : Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National andlocal levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic

species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III: Environmental Pollution and Solid Waste Management ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

Air Pollution.

Water pollution

Soil pollution

Marine pollution

Noise pollution

Thermal pollution

Nuclear hazards

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

UNIT – IV: Social Issues and the Environment

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

UNIT – V: Human Population and the Environment

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health

– Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

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

Text Books

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha forUniversity Grants Commission, Universities Press.
2. Environmental Studies by Palaniswamy – Pearson education
3. Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

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

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

CO1	**Understand** the concepts of the ecosystem
CO2	**Understand t**he natural resources and their importance
CO3	**Learn** Various attributes of the pollution and their impacts
CO4	**Understand** Social issues both rural and urban environment
CO5	**Understand** about environmental impact assessment and Evaluate the stages involved in EIA

III-Year-II Semester
PC3218

DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

Pre-Requisites: Signals & Systems, Mathematics, Concept of Communications

Course Objectives:

1. Analyze the Discrete Time Signals and Systems
2. Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3. Learn the FIR and IIR Filter design procedures
4. Able to realize the digital filters with different structures
5. Know the need of Multirate Processing

UNIT-I

Introduction to Discrete Time Signals & Systems. (12 Hrs.) Introduction to Digital Signal Processing, Discrete time Signals, Signal Processing, Discrete timeSystems, Linear Shift Invariant Systems, Condition for Stability. Linear Constant Coefficient Difference Equations, Discrete Time Fourier Transformation and its Properties, LinearConvolution, Review of Z-Transforms –Solutions of Difference Equations using Z-Transforms,Stability Criteria in Z-Transform.

UNIT-II

DFT& FFT (14 Hrs.)

DFS, Properties of DFS, DFT, Properties of DFT, DFT as Linear Transformation, Circular Convolution, Sectional Convolution-Overlap Add and Overlap Save Methods , LinearConvolution using Circular Convolution.

Introduction to FFT, Efficient Computation of DFT, Radix-2 Algorithms-Decimation in Time and Decimation in Frequency Algorithms, Inverse DFT using FFT .

UNIT-III Design And Realization of IIR filters (12Hrs.)

Introduction to Digital Filters, Analog Filter Approximations-Butterworth &Chebyshev, Digital IIR Filters Design from Analog filters, Analog and Digitalfrequency transformations. Basic structures of IIR systems, Transposed forms

UNIT-IV

Design And Realization of FIR filters (15 Hrs.) Introduction to FIR Filters, Characteristics of FIR Filters, Frequency Response, Design of FIR Filters- Fourier Series Method , Frequency Sampling method and Window Method. Basic structures of FIR systems.

UNIT-V

Multirate Digital Signal Processing h(10 Hrs.)

Introduction, Down Sampling, Decimation, Spectrum of Down Sampling, Up Sampling, Interpolation, Spectrum of Up Sampling, Cascading Sample Rate Converters, Sampling Rate Conversion, Applications of Multirate DSP.

Text Books

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis,Dimitris G.Manolakis,Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI
3. Digital Signal Processors – Architecture, Programming andApplications,B.Venkataramani, M.Bhaskar, TATAMcGraw Hill, 2002

Reference Books

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
3. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006
4. Digital Signal Processing – Ramesh babu, Sci Tech publications

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

CO1	Analyze the Discrete Time Signals and Systems& Apply the difference equations conceptin the analysis of Discrete time systems
CO2	Know the importance of FFT algorithm for computation of Discrete Fourier Transform & Use the FFT algorithm for solving the DFT of a given signal
CO3	Able to realize and design the IIR digital filters
CO4	Able to realize and design the IIR digital filters
CO5	Know the need of Multirate Processing, Use the Multirate Processing concepts in variousapplications

III- Year-II Semester PC3219	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

Pre-Requisites: STLD, Computer Architecture and Organization

Course Objectives:

1. To acquire knowledge about microprocessors, and study the Architectures of 16-bitMicroprocessors.
2. To learn the concept of Assembly language and programming skills.
3. To acquire the knowledge on interrupts, interfacing with various peripherals configure and develop programs to interfacing peripherals/sensors.
4. To understand the fundamental concepts of Microcontrollers and their architecture.
5. To study the concepts of ARM processors and their architecture

UNIT-1

8086/8088 Microprocessor: Architecture, Bus Interfacing Unit, Memory Segmentation and Physical Address Computations, Execution Unit, Register Organization of 8086, Pin Diagrams, Signal Descriptions, Minimum Mode of 8086 System and Timings, Maximum Mode of 8086 System and Timings, Introduction to Stack, Stack Structure of 8086, The Processor 8088, Difference Between 8086 and 8088, Addressing modes of 8086.

UNIT-II

8086 Programming: Program development steps, 8086 instructions: Data Transfer Instructions, Arithmetic Instructions, Bit Manipulation Instructions, String Instructions, Program Execution Transfer Instructions (Branch & Loop Instructions), Processor Control Instructions, Iteration Control Instructions and Interrupt Instructions, Assembler Directives, Machine Language Instruction Formats, Introduction to TASM, writing simple programs with an assembler, assembly language program development tools.

UNIT-III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, stepper motor, A/D and D/A converters, software and hardware interrupt applications, Need for 8259 programmable interrupt controllers, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller.

UNIT-IV

Intel 8051 Microcontroller: Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. Interfacing to 8051: A/D and D/A Convertors, Stepper motor interface, keyboard, LCD Interfacing, Traffic light controls.

UNIT-V

ARM Architectures and Processors: ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, functions and interfaces.

Programmers Model – Modes of operation and execution, Instruction set summary, System address map, write buffer, bit-banding, processor core register summary, exceptions. ARM Cortext-M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller – functional description and NVIC programmers' model.

Text Books

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition,1994.

2.A.K.Ray and K.M. Bhurchandi, "Advanced Microprocessor and Peripherals" Tata McGraw Hill, 3rd Edition, 2013

3. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad AliMazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 2-Edition, 2011.

4.The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by

JosephYou
Reference Books
1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media,2017. 2. Cortex -M3 Technical Reference Manual.
E-Resources: 1. https://nptel.ac.in/courses/106/108/106108100/ 2. https://nptel.ac.in/courses/117/104/117104072/# 3. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ee42/ 4. https://nptel.ac.in/courses/108/107/108107029/

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

CO1	**Understand** the architecture of microprocessor and their basic hardware components andoperation. **{Understanding level, KL1}**
CO2	**Demonstrate** programming skills in assembly language for processors. **{Analysis level, KL4}**
CO3	**Analyze** various interfacing techniques and apply them for the design of processor **{Analysis level, KL4}**
CO4	**Understand** the architecture of microcontroller and their operation **{Understanding level, KL1, KL2}**
CO5	Able to illustrate how the different on ARM Cortex processors and debug. **{Analyzing level, KL3}**

III-Year-II Semester PC3220	MICROWAVE ENGINEERING AND OPTICAL COMMUNICATIONS	L	T	P	C
		3	0	0	3

Pre-Requisites: Analog and Digital Communications, Basics related to RF field Analysis

Course Objectives:

1. To understand fundamental characteristics of rectangular waveguide
2. To understand the basic properties of waveguide components and microwave sources.
3. To understand the characteristics and construction of optical fiber cables and develop theknowledge of fiber splicing and connectors.
4. To identify and understand the operation of various optical sources & optical detectorsoperation and optical system design.
5. To understand the measurement techniques of microwave and optical.

UNIT I: MICROWAVE TRANSMISSION LINES:

Introduction, Microwave Spectrum and Bands, Applicationsof Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fieldsand Cut-off Frequencies, Dominantand Degenerate Modes, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations, Impossibility of TEM mode, Related Problems

UNIT II: WAVEGUIDE COMPONENTS AND APPLICATIONS(Qualitative treatmentonly):

Scattering matrix parameters: Definition, Properties, Salient Features -S-parameters of two port,three port, four port networks related to E-Plane Tee, H-Plane Tee, Hybrid Tee Junction Directional Coupler, Isolator, Gyrator and Circulator.

MICROWAVE TUBES (Qualitative treatment only) & SOLID STATE DEVICES:

Two Cavity Klystrons-Structure, Velocity Modulation and Bunching process, Reflex KlystronsStructure, principle of working. HELIX TWTS: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT, Gunn Diode – Principle, RWH Theory, Characteristics, LSA Mode of operation

UNIT III: OPTICAL FIBER COMMUNICATION: Over view of optical fiber communication, Total Internal Reflection, Numerical Aperture, Graded index fibers, Cut offwavelength, Related Problems.

OPTICAL FIBER CONNECTORS-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing- Splicing techniques, Splicing single mode fibers, Multimode fiber joints, single mode fiber joints

UNIT IV: OPTICAL SOURCES AND DETECTORS:
Qualitative treatment, Structures, Materials, Quantum efficiency, Physical principles and comparison ofOptical sources and detectors, Related problems. Optical system design- Point to point links – Component Choice and considerations, Link power budget, Line coding in Opticallinks, WDM, Necessity, Principles, Eye pattern.

UNIT –V: MEASUREMENTS:
a. MICROWAVE MEASUREMENTS: Description of Microwave Bench- Different Blocks, Microwave Power Measurement- Bolometer Method. Measurement of Attenuation by ReflectionMethod, VSWR, Impedance Measurement
b. OPTICAL MEASUREMENTS: OTDR, Attenuation, Detector Characteristics

Text Books

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rdEdition,1994.

2. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley,2ndEdition,2002.

3. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition,3rdEdition,2000.

Reference Books

1. Microwave Engineering- Annapurna Das and Sisir K.Das, Mc Graw HillEducation, 3rdEdition,2014.

2. Microwave Engineering – G S N Raju , I K International Publishing House Pvt. Limited,2008.

3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.

E-Resources & other digital material:

NPTEL Lecture material

1. Lecture Series on Microwave Engineering by Prof. Ratnajit Bhattacharjee, Department of Electrical Engineering, IIT Guwahati, https://onlinecourses.nptel.ac.in/noc20_ee91/.
2. Lecture Series on Optical Fiber Communications by Prof. Deepa Venkatesh, Department of Electrical Engineering, IIT Madras. https://nptel.ac.in/courses/108/106/108106167/.

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

CO1	**Design** different modes in rectangular waveguide structures
CO2	**Calculate** S-matrix for various waveguide components and splitting the microwave energy in a desired direction and operation of microwave tubes and analysis
CO3	**Design** and Implementation of various optical fiber cables and optical fiber connectors
CO4	**Design** and implementation of various optical sources and detectors for various real time operations and also observed the optical system design
CO5	**Measurement** of various microwave parameters using a Microwave test bench and optical measurements using block diagram operations.

III- Year-II Semester

PE3201

ANTENNAS AND WAVE PROPAGATION

Professional Elective-1

L	T	P	C
3	0	0	3

Pre-Requisites: Analog and Digital Communications, Basics related to RF field Analysis

Course Objectives:

1. Analyze the antenna parameters with respect to electromagnetic waves
2. Understand the behavior of electromagnetic wave analysis to various types of dipoleantennas.
3. Understand the antenna array design to increase filed strength in the desired direction
4. Familiarize various types of microwave antennas for real time applications
5. Understand the concept of radio wave propagation in the atmosphere

UNITI

Antenna Basics: Antenna Parameters: Introduction, Radiation Patterns, Beam width, Beam area, Radiation Intensity, Beam Efficiency, Directivity, Gain, Resolution, Antenna Efficiency, Antenna apertures, Types of antenna apertures, Effective height, Front to Back Ratio, Relationship between Directivity and Effective aperture, Radiation resistance, Radial power flow, Field regions of Antenna, illustrated problems.

UNITII

THIN LINEAR WIRE ANTENNAS: Retarded Potentials, Basic Antenna Elements, Radiationfrom small electric dipole, Half wave Dipole, Quarter wave monopole- Evaluation of field components, power radiated, Radiation Resistance, Directivity, Effective Area and Effective Height. Antenna Theorems- Applicability and proofs for equivalence and directional characteristics, Illustrated Problems

UNITIII

ANTENNA ARRAYS: Introduction, Various forms of Antenna arrays, Array of 2-point sources different cases, Principle of Pattern Multiplication for 2- and 4-point sources, N-Element Uniform Linear Arrays- Broadside, End-fire Arrays, EFA with increased Directivity, Derivation of their characteristics and comparison, Directivity Relations (no derivations), Binomial Arrays, Related Problems, Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded dipoles and their characteristics. Phased array Antennas.

UNITIV

Helical Antennas- Significance, Geometry, basic properties; Design consideration for helical Antenna in Axial Mode and Normal Modes (Qualitative Treatment). Reflector Antennas: Flat Sheet and Corner Reflectors. Parabolic Reflectors: Geometry, characteristics, types of feeds, F/D Ratio, Spill over, Back Lobes, Aperture Blocking, Off-set Feeds, and Cassegrain Feeds. Antenna

Measurements: Radiation Patterns, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3-Antenna Methods)

UNITV

Wave Propagation: Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation–Characteristics, Fundamental Equation for Free Space Propagation, Basic Transmission Loss Calculations, Space Wave Propagation– Mechanism, LOS and Radio Horizon, Tropospheric Wave Propagation – Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations

Text Books

1. Antennas and Wave Propagation - John D. Kraus and Marhefka Khan, 4 th Edition, TMH,2006.

2. Antenna Theory - C.A. Balanis, John Wiley and Sons, 2nd Edition, 2001.

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

Reference Books

1. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2ndEdition, 2000
2. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th Edition, 1955.
3. Antennas and wave propagations DAS TMH,2016

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

CO1	**Understand & remember** the fundamentals of antenna theory for designing various Antennas
CO2	**Evaluate** the Electric and Magnetic Field Equations for basic antennas at Far Field conditions
CO3	**Construct** the basic array system in antennas and **Draw** the Radiation Mechanisms fordifferent types of arrays.
CO4	**Analyze** the operation of VHF, UHF and Microwave Antennas.
CO5	**Identify** and **explain** the atmospheric and terrestrial effects on radio wave propagation.

III-Year-II Semester
PE3201

INFORMATION THEORY & CODING
Professional Elective-1

L	T	P	C
3	0	0	3

Pre-Requisites: Digital Communications

Course Objectives:

1. To acquire the knowledge in measurement of information and errors.
2. Understand the importance of various codes for communication systems.
3. To design encoder and decoder of various codes.
4. To known the applicability of source and channel codes.

UNIT I

Coding for Reliable Digital Transmission and Storage

Block Diagram of Data Transmission System, Discrete Memoryless Sources, Logarithmic Measure of Information, Average Information and Entropy, Information Rate, Discrete Memoryless Channels, Mutual Information, Source Coding - Shannon-Fano Coding, Huffman Coding.

UNIT II

Linear Block Codes

Introduction to Error Control Coding, An Example of Error Control Coding, Methods of Controlling Errors, Types of Errors, Types of Codes, Introduction to Linear Block Codes, Matrix Description, Encoding and Decoding, Error-Detecting and Error-correcting Capabilities of a Block code, Single Error-Correcting Hamming Codes, Table Lookup Decoding Using the Standard array. Applications of Block codes for Error Control in Data Storage System

UNIT III

Cyclic Codes

Description, Algebraic Structure of Cyclic Codes, Encoding, Decoding - Syndrome Calculation, Error Detection, and Error Correction. Encoding and Decoding Using an (n-k) Bit Shift Register, Shortened Cyclic Codes, Majority Logic Decoding for Cyclic Codes

UNIT IV

Convolutional Codes

Encoder for Convolutional Codes, Transform Domain Approach, Graphical Approaches - State, Tree, and Trellis Diagrams, Decoder for Convolution Codes – Exhaustive Search Method, Majority Logic (Threshold) Decoding, Maximum Likelihood Decoding, The Viterbi Algorithm. Performance of Convolutional Codes.

UNIT V

BCH Codes

Introduction, Properties of Binary BCH Codes, Galois Fields, Primitive Elements, Primitive Polynomials, Minimal Polynomials, Generator Polynomials for BCH Codes, Multiple Error Correcting BCH Codes, Decoding of BCH codes.

Text Books

1. Digital And Analog Communication Systems – K.Sam Shanmugam, Wiley
2. Error Control Coding- Fundamentals and Applications —Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.

Reference Books

1. Digital Communications- John G. Proakis, 5th Ed., TMH, 2008.
2. Introduction to Error Control Codes-Salvatore Gravano, oxford
3. Error Correction Coding — Mathematical Methods and Algorithms - Todd K.Moon, Wiley India, 2006.
4. Information Theory, Coding and Cryptography — Ranjan Bose, 2nd Ed., TMH, 2009

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

CO1	Learn measurement of information and errors
CO2	Design encoders and decoders for block codes
CO3	Design encoders and decoders cyclic codes

CO4	Understand the significance of Convolutional codes in various applications
CO5	Understand the significance of BCH codes in various applications

III-Year-II Semester
PE3201

SPEECH FUNDAMENTALS
Professional Elective-1

L	T	P	C
3	0	0	3

Pre-Requisites: Signals and systems

Course Objectives:

1. Understand the basics of speech production, perception, and communication.
2. Analyze various components of speech, including articulation, phonetics, and prosody.
3. Develop effective verbal communication skills.
4. Apply knowledge of speech fundamentals to practical scenarios.
5. Appreciate the role of speech in human interaction and communication

Unit I: Introduction to Speech Fundamentals Definition and importance of speech communication, Basic elements of speech production and perception, Anatomy and physiology of speech production, Overview of speech acoustics and auditory perception.
Unit II: Articulation and Phonetics Speech articulators and their functions, International Phonetic Alphabet (IPA) and phonetic transcription, Consonants and vowels: classification and production, Coarticulation and connected speech processes
Unit III: Prosody and Intonation Importance of prosody in speech communication, Pitch, rhythm, and stress patterns, Intonation patterns and their communicative functions, Cross-cultural differences in prosody.
Unit IV: Speech Disorders and Varieties Overview of speech disorders (e.g., articulation disorders, stuttering), Accents, dialects, and language variations, Multilingualism and its impact on speech communication, Speech assessment and intervention strategies
Unit V: Public Speaking and Effective Communication Principles of effective public speaking, Audience analysis and adaptation, Delivery techniques: voice modulation, pacing, and pauses, Overcoming speech anxiety and stage fright.

Text Books & Reference Books

1. "An Introduction to Language" by Victoria Fromkin, Robert Rodman, and Nina Hyams.
2. "The Acoustics of Speech Communication: Fundamentals, Speech Perception Theory, and Technology" by J.R. Frisina and A.N. Popper.
3. "Introduction to Phonetics and Phonology: From Concepts to Transcription" by Jacqueline Bauman-Waengler.
4. "The Elements of Eloquence: How to Turn the Perfect English Phrase" by

Mark Forsyth.
5. "The King's Speech: How One Man Saved the British Monarchy" by Mark Logue and Peter Conradi.

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

CO1	**Speech Fundamentals:** Understand the foundational concepts of speech production, perception, and communication.
CO2	**Phonetics Mastery:** Analyze and transcribe speech sounds using the International Phonetic Alphabet (IPA).
CO3	**Effective Prosody:** Demonstrate an understanding of prosody and intonation patterns in speech communication.
CO4	**Speech Disorders:** Identify common speech disorders and variations and their impact on communication.
CO5	**Public Speaking Skills:** Develop effective public speaking skills, including audience analysis and delivery techniques.

III- Year-II Semester	ANALOG IC DESIGN	L	T	P	C
PE3201	Professional Elective-1	3	0	0	3

Pre-Requisites: Microwave Engineering

Course Objectives:

1. Understand the behavior of MOS Devices and Small-Signal & Large-Signal Modeling of MOS Transistor and Analog Sub-Circuits.
2. Learn and understand CMOS Amplifiers like Differential Amplifiers, Cascode Amplifiers, Output Amplifiers, and Operational Amplifiers.
3. Design and Develop the Analog CMOS Circuits for different Analog operations.
4. Learn and understand the concepts of Open-Loop Comparators
5. Design of Different Types of Oscillators like Ring Oscillator, LC Oscillator etc.

UNIT -I:

MOS Devices and Modelling:

The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modelling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT -II:

Analog CMOS Sub-Circuits:

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT -III:

CMOS Amplifiers:

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

CMOS Operational Amplifiers:

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op

Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT -IV:

Comparators: Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete Time Comparators

UNIT -V:

Oscillators & Phase-Locked Loops: General Considerations, Ring Oscillators, LC Oscillators, Voltage Controlled Oscillators.

Simple PLL, Charge Pump PLLs, Non-Ideal Effects in PLLs, Delay Locked Loops, Applications.

Text Books

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, Second Edition.

2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition,2010.

Reference Books

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition,2010.
2. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn,2013.

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

CO1	Model and simulate different MOS Devices using small signal Model.
CO2	Design and analyze any Analog Circuits in real time applications
CO3	Apply the concepts Analog Circuit Design to develop various Applications in Real Time
CO4	Analyze and compare different Open-Loop Comparators and Oscillators

CO5	Understand the concept about PLL and its operations

III-Year-II Semester **MICRO PROCESSORS AND**
PC3221L **MICRO CONTROLLERS LAB**

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To understand basic Programming through MASM/TASM for 8086
2. To understand programming through microprocessor for different interfacing
3. To understand assembly language programs using 8051 microcontrollers
4. To experiment assembly language programs for various applications using 8051
5. To Examine Switches, 7- Segment Displays, Stepper motor Interfacing, Traffic light controller using 8051 microcontroller interfacing.

List of Experiments: (Minimum of Ten Experiments has to be performed)

LIST OF EXPERIMENTS

PART- A: (Minimum of 5 Experiments has to be performed)

8086 Assembly Language Programming using Assembler Directives

1. Programs for 16 -bit arithmetic operations (using Various Addressing Modes).
   a. Addition of n-BCD numbers.
   b. Multiplication and Division operations.
2. Programs for Sorting
3. Program for Sum of squares/cubes of a given n-numbers
4. Program for factorial of given n-numbers
5. Stack operations
6. BCD to Seven segment display codes

PART- B: (Minimum of 3 Experiments has to be performed) 8086 Interfacing

1. Hardware/Software Interrupt Application
2. A/D Interface through Intel 8255
3. D/A Interface through Intel 8255
4. Keyboard and Display Interface through Intel 8279
5. Generation of waveforms using Intel 8253/8254

PART- C: (Minimum of 3 Experiments has to be performed) 8051 Assembly Language Programs

1. Finding number of 1's and number of 0's in a given 8-bit number
2. Addition of even numbers from a given array
3. Ascending / Descending order
4. Average of n-numbers

PART-D: (Minimum of 3 Experiments has to be performed) ARM Programs (using µVision IDE software)

1. Addition two 64 bit numbers
2. Smallest of n numbers
3. Convert hex to ASCII
4. Generate n fibonic numbers
5. Factorial of a given number using subroutine
6. Multiplication of two 32 bit numbers

Equipment Required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. 8086 Microprocessor kits
4. 8051 microcontroller kits
5. TASM software
6. µVision IDE - Keil software
7. ADC module
8. DAC module
9. Stepper motor module
10. Keyboard module
11. LED, 7-Segemt Units
12. Digital Multimeters
13. ROM/RAM Interface module
14. Bread Board etc

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

CO1	Understand about basic Programming through MASM/TASM for 8086 Microprocessor **(Understand)**
CO2	Experiment programming through microprocessor for different interfacing with 8086 microprocessor. **(Analyze)**
CO3	Understand assembly language programs using 8051 microcontroller. **(Understand)**
CO4	Experiment assembly language programs for various applications using 8051Microcontroller. **(Analyze)**
CO5	Examine Switches, 7- Segment Displays, Stepper motor Interfacing, Traffic light controller using 8051 microcontroller interfacing. **(Analyze)**

III-Year-II Semester **MICROWAVE ENGINEERING AND**
PC3222L **OPTICAL COMMUNICATION LAB**

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To Identify and demonstrate the working of various microwave Passive components.
2. To Analyze the characteristics of different microwave sources.
3. To Evaluate scattering parameters of microwave passive components
4. To Analyze the characteristics of different optical sources
5. To Evaluate various optical fiber parameters and analyze an optical fiber communication link

LIST OF EXPERIMENTS:

List of Experiments: (Minimum of Ten Experiments has to be performed)

PART-A (Any Five Experiments)

1. Gunn Diode Characteristics
2. Waveguide Parameters
3. Attenuation Measurement
4. Scattering parameters of Magic Tee
5. Directional Coupler Characteristics
6. Radiation Pattern of Horn Antenna
7. Reflex Klystron Characteristics

PART-B (Any Five Experiments)

8. Measurement of Numerical Aperture
9. Characterization of LED
10. Characterization of Laser Diode
11. Measurement of Data rate for Digital Optical link
12. Measurement of losses for Analog Optical link
13. Intensity modulation of Laser output through an optical fiber

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

CO1	Identify and demonstrate the working of various microwave Passive components. **(Understand)**
CO2	Analyze the characteristics of different microwave sources. **(Analyze)**
CO3	Evaluate scattering parameters of microwave passive components. **(Evaluate)**
CO4	Analyze the characteristics of different optical sources. **(Analyze)**
CO5	Evaluate various optical fiber parameters and analyze an optical fiber communication link. **(Evaluate)**

III Year II Semester

PC3223L	DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To Understand how to generate elementary signals, perform arithmetic operations on signals.
2. To Implement FFT of given sequence and analyze signals in transform domain.
3. To Determine frequency response of analog filters
4. To Analyze the spectral parameter of window functions and design FIR filters
5. To Design IIR filters

LIST OF EXPERIMENTS:

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. To study the architecture of DSP chips – TMS320 5X/6X instructions
2. To verify linear convolution
3. To verify circular convolution
4. To design FIR filter (LP/HP) using windowing technique
    a. Using rectangular Window
    b. Using triangular Window
    c. Using Kaiser Window
5. To implement IIR filter (LP/HP) on DSP Processor
6. N-point FFT algorithm
7. MATLAB program to generate sum of sinusoidal signals
8. MATLAB program to find frequency response of analog LP/HP filters
9. To compute power density spectrum of a sequence
10. To find the FFT of given 1-D signal and plot
11. Detection of QRS complex of ECG signals
12. Generation and detection of DTMF signals

13. Speech compression using Linear Predictive Coding

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

CO1	Understand how to generate elementary signals, perform arithmetic operations on signals
CO2	Implement FFT of given sequence and analyze signals in transform domain
CO3	Determine frequency response of analog filters
CO4	Analyze the spectral parameter of window functions and design FIR filters
CO5	Design IIR filters

III-Year-II Semester	WEB DEVELOPMENT	L	T	P	C
SC3204		1	0	2	2

Course Objectives:

1. Creating web pages using HTML5 and CSS
2. Implementing Interactive web interfaces with client-side technologies.
3. Create and validate XML documents.
4. Interacting with Database

Unit-I:

HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, HTML styles, Elements, Attributes, Heading, Layouts, HTML media, Iframes Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML

Unit-II:

Javascript - Introduction to Javascript, Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions

Unit-III:

Working with XML: Document type Definition (DTD), XML schemas, XSLT.

Unit-IV:

PHP Programming: Introduction to PHP, Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements

Unit-V:

My SQL: Creating Database, Data Types, Basic Operations on tables (Create, Select, Delete and Update).

Text Books

1. 1. HTML5 Black Book Covers CSS3, Java script, XML, XHTML, AJAX, PHP and jQuery, Dream tech Press (2011).

2. 2. Robin Nixon, Learning PHP, My SQL, Java Script & CSS‖, 2nd Edition, O'REILLY (2012).

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

CO1	Describe the concepts of World Wide Web, and the requirements of effective web design.
CO2	Develop web pages using the HTML and CSS features with different layouts as per need of applications.
CO3	Use the JavaScript to develop the dynamic web pages.
CO4	Construct simple web pages in PHP and to represent data in XML format.
CO5	Use server-side scripting with PHP to generate the web pages dynamically using the database connectivity

III-Year-II Semester	UNDERSTANDING HARMONY UNIVERSAL HUMAN VALUES – 2	L	T	P	C
HS3205		3	0	0	3

Pre-Requisites: None. Universal Human Values 1

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (humanbeing), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society andnature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and ExperientialValidation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal ofPhysical needs, meaning of Prosperity in detail

Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goodsavailable to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universalvalues in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; theother salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order-from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence asCoexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature recyclabilityand self regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all pervasivespace
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Text Books

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

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

CO1	Understanding the content and process for Value education.
CO2	Understanding the harmony in the human being, family, society and nature/existence
CO3	Apply the Strengthening of self-reflection.
CO4	Apply to All levels become sensitive to their commitment towards what they have understood (human values, human relationship and human society)
CO5	Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

III- Year-II Semester

MC3204

ENTREPRENEURIAL SKILL DEVELOPMENT

L	T	P	C
2	0	0	0

Pre-Requisites: Basic Sciences and Humanities.

Course Objectives:

1. To impart the basic knowledge of entrepreneurship skills for better understanding ofentrepreneurial scenario.
2. To understand the knowledge of theories of entrepreneurship and to motivate students tobecome entrepreneur.
3. To identify opportunities in starting own ventures.
4. To understand and plan business model for a startup.
5. To analyze the role of government and non-government institutions in supportingentrepreneurial activities.

Unit 1

Foundation of Entrepreneurship 10 hrs

Concept and Need of Entrepreneurship, Characteristics and types of Entrepreneurships, Charm of becoming Entrepreneur, Entrepreneurial decision process, Entrepreneurship as a career, Entrepreneurship as style of management, changing role of Entrepreneur, Entrepreneurial traits, factors effecting Entrepreneur.

Unit 2

Theories of Entrepreneurship and Entrepreneurial motivation 12 Hrs

Influences of Entrepreneurship development, external Influences of Entrepreneurship development, Socio – cultural, political and economical, personal entrepreneurial success and failure, reason and remedies, women entrepreneurs, challenges and achievements of women entrepreneurs. Meaning of Entrepreneurial motivation, motivation cycle or process, theories of Entrepreneurial motivation, Entrepreneurial motivational factors, changes in Entrepreneurial

motivation.

Unit 3

Opportunities Identification and Selection 10 Hrs

Need for opportunities identification and selection, Environmental Dynamics and Changes, Business Opportunities in various sectors, Identification of Business opportunities, and Opportunity selection.

Unit 4

Business Planning Process 10 Hrs

The business plan as an entrepreneurial tool, Elements of business planning, Objectives, Market analysis, Development of product/idea, Marketing, Finance, organization and management, Ownership, Critical risk contingencies of the proposal, Scheduling and milestones.

Unit 5

Entrepreneurial Development and Government 10 Hrs

Role of Central Government and State Government in promoting entrepreneurship with various incentives, subsidies, grants, programmed schemes and challenges, Government initiatives and inclusive entrepreneurial growth.

Text Books

1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath,2e, Pearson, 2014.
2. P.Narayana Reddy, Entreprenurship, Cengage Learning, New Delhi,2010.
3. Steven Fisher, Ja-nae Duane, The startup equation – A visual guide book for building yourstartup, Indian edition, McGraw Hill Education India Pvt. Ltd. 2016.
4. Arya Kumar: "Entrepreneurship", Pearson, Publishing House, New Delhi, 2012.
5. VSP Rao, Kuratko: "Entrepreneurship', Cengage Learning, New Delhi, 2011.
6. K.Ramachandran: "Entrepreneurship Development", TMH, New Delhi, 2012.
7. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 2009.
8. Dollinger: Entrepreneurship, Pearson, 2009

Reference Books

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. Entrepreneurship, a South – Asian Perspective, D.F. Kuratko and T. V. Rao, 3e, Cengage,2012.
3. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, HimalayaPublishing House, 2015.
4. AnajanRai Chaudhuri, Managing new ventures, concepts and cases, Prentice HallInternational, 2010.
5. Rajeev Roy: Entrepreneurship, Oxford university press, New Delhi, 2010

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

CO1	The basics of entrepreneurship skills for better understanding of entrepreneurial scenarioare understood
CO2	Apply Knowledge of theories of entrepreneurship and to identify entrepreneurialopportunities for women
CO3	Identify opportunities supporting entrepreneurship
CO4	Analyze the milestones and related challenges in developing new venture
CO5	Understand government role supporting entrepreneurship

IV- Year-I Semester
20PE4102

ADVANCED COMPUTER ARCHIECTURE
(Professional Elective – 2)

L	T	P	C
3	0	0	3

Pre-Requisites: Computer Organization.

Course Objectives:

1. Understand advanced concepts in computer architecture beyond the basics.
2. Analyze complex computer system designs and architectures.
3. Design and evaluate advanced architectural features for improving performance.
4. Apply knowledge of computer architecture to address modern computing challenges.
5. Explore emerging trends and technologies in computer architecture.

Unit I: Advanced Processor Design Pipeline hazards and techniques for hazard handling, Superscalar and VLIW architectures, Out-of-order execution and register renaming, Advanced branch prediction techniques.
Unit II: Memory Hierarchy Design Advanced memory hierarchies: multi-level caches and cache coherence, Virtual memory systems and advanced paging techniques, Memory management units (MMUs) and TLB design, Non-volatile memory technologies and their impact on memory hierarchies.
Unit III: Parallel Processing Architectures Flynn's taxonomy and classification of parallel architectures, SIMD and MIMD architectures, multi-core and many-core processors, GPU architectures and parallel programming models
Unit IV: Advanced Instruction-Level Parallelism Dynamic scheduling and speculative execution, Advanced techniques for exploiting ILP, Vector processing and multimedia extensions, SIMD and SIMT architectures for data-parallel workloads
Unit V: Emerging Architectures and Technologies Quantum computing and its architectural implications, Neuromorphic computing and brain-inspired architectures, Edge and fog computing architectures, Security and reliability considerations in modern architectures

Text Books	
1.	"Computer Architecture: A Quantitative Approach" by John L. Hennessy and David A. Patterson.
2.	"Computer Organization and Design: The Hardware/Software Interface" by David A. Patterson and John L. Hennessy.
3.	"Advanced Computer Architecture: Parallelism, Scalability, Programmability" by Kai Hwang and Naresh Jotwani.
Reference Books	
1.	"Computer Architecture: Concepts and Evolution" by Gerrit A. Blaauw and Frederick P. Brooks Jr.S
2.	"Parallel Computer Architecture: A Hardware/Software Approach" by David Culler, J.P. Singh, and Anoop Gupta

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

CO1	**Advanced Understanding:** Grasp advanced concepts in computer architecture, including processor design and memory hierarchy.
CO2	**Architectural Analysis:** Analyze and compare complex computer architectures, including parallel processing systems.
CO3	**Performance Improvement:** Design and evaluate advanced architectural features to enhance system performance.
CO4	**Modern Challenges:** Apply computer architecture knowledge to address challenges in modern computing environments.
CO5	**Emerging Trends:** Explore and discuss emerging trends and technologies in computer architecture

IV- Year-I Semester 20PE4102	RADAR ENGINEERING (Professional Elective – 2)	L	T	P	C
		3	0	0	3

Pre-Requisites: Antennas and Wave propagation and Microwave Engineering.

Course Objectives:

1. Understand the basic principle of radar and range equation
2. Learn different types of radars: CW, MTI and Pulse Doppler Radars
3. Understand the different tracking techniques for radar
4. Understand the functioning of the Radar Antenna.
5. Understand the Transmitters & Receivers used in radar systems.

UNIT -I **14Hrs**

INTRODUCTION TO RADAR: Basic Radar, The Simple form of Radar Equation, Radar Block Diagram, Radar Frequencies, Applications of Radar.

The RADAR EQUATION: Introduction, Detection of Signals in Noise,Receiver Noise and the Signal to Noise Ratio, Probabilities of Detection and False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, Pulse Repetition Frequency and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

UNIT – II **14Hrs**

MTI AND PULSE DOPPLER RADAR: Introduction to CW, FM-CW, Multiple Frequency CW Radar, Doppler and MTI Radar, Delay Line Cancellers, Staggered PRFs, Doppler Filter Banks, Limitations to MTI Performance, Pulse Doppler Radar.

UNIT – III **12Hrs**

TRACKING RADAR: Tracking with Radar, Mono pulse Tracking Radar – Amplitude-Comparison Mono Pulse, Phase-Comparison Mono Pulse, Sequential Lobing, Conical Scan, Tracking in Range, Acquisition, Comparison of Trackers.

UNIT – IV **12Hrs**

THE RADAR ANTENNA: Functions of the Radar Antenna, Antenna Parameters, Reflector Antennas, electronically steered Phased Arrays antennas, Phase Shifters, Radomes.

UNIT – V **12Hrs**

RADAR RECEIVERS: The Radar Receiver, Receiver Noise Figure, Superheterodyne

Receiver,Duplexers and Receiver Protectors, Radar Displays.

DETECTION OF SIGNALS IN NOISE: Introduction, Matched Filter Receiver, Detection Criteria, Detectors, Automatic Detection, Integrators, Constant – False Alarm Rate Receivers, Navigational Aids: Direction Finder, VOR, ILS and Loran.

Text Books

1.Introduction to Radar Systems, 3rd Edition – M.I. Skolnik, TMH Ed., 2005

Reference Books

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.
2. Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.
3. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.
4. Principles of Modern Radar: Basic Principles – Mark A. Richards, James A. Scheer, William A. Holm, Yesdee
5. Radar Engineering and Fundamentals of Navigational Aids – GSN Raju, IK International

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

CO1	Understand the Range ambiguities and radar range equation
CO2	Explain different types of radars like CW, MTI and Pulse Doppler Radars.
CO3	Evaluate how to track one or more positions of the target using tracking techniques
CO4	Explain functioning of without physical moment how to do beam steering using arrays
CO5	Describe Various radar Transmitters & Receivers

IV-Year-I Semester
20PE4102

SPEECH PROCESSING

(Professional Elective – 2)

L	T	P	C
3	0	0	3

Pre-Requisites: Signals and Systems and Probability Theory and Stochastic Processes

Course Objectives:

1. Understand the anatomy and Physiology of Speech Production system and perception model and to design an electrical equivalent of Acoustic model for Speech Production.
2. To analyze the speech in time domain and extract various time domain parameters which can be used for various applications like pitch extraction, end point detection, Speech Compression, Speech Synthesis etc.,
3. To study the concept of Homomorphic system and its use in extracting the vocal tract information from speech using Cestrum which is a bye product of Homomorphic processing of Speech.
4. To study various Speech Signal Processing applications viz: Speech Enhancement, Speech Recognition, Speaker Recognition

UNIT I

Fundamentals of Digital Speech Processing

Anatomy & Physiology of Speech Organs, The process of Speech Production, The Acoustic Theory of Speech Production – Uniform lossless tube model, effect of losses in vocal tract, effect if radiation at lips, Digital models for speech signals.

UNIT II

Time Domain Models for Speech Processing

Introduction- Window considerations, short time energy and average magnitude short time average zero crossing rate, Speech vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach. The short time autocorrelation function, the short time average magnitude difference function, Pitch period estimation using the autocorrelation function

UNIT III

Linear predictive Coding (LPC) Analysis

Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equation, comparison between the Method of Solution of the LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis

using LPC Parameters

UNIT IV

Homomorphic Speech Processing

Introduction Homomrphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, pitch Detection, Formant Estimation, and The Homomorphic Vocoder.

Speech Enhancement- Nature of interfering sounds, Speech enhancement techniques: Single microphone Approach: spectral subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi microphone Approach

UNIT V

Automatic Speech & Speaker Recognition

Basic pattern recognition approaches, parametric representation of speech, evaluating the similarity of speech patterns, isolated digit Recognition System, Continuous digit Recognition System

Hidden Markov Model (HMM) for Speech

Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS.Speaker Recognition

Recognition techniques, Features that distinguish speakers, Speaker Recognition Systems: Speaker Verification Systems, Speaker identification Systems

Text Books

1. Digital Processing of Speech Signals – L.R. Rabinar S. W. Schafer. Pearson Education.
2. Speech Communication: Human & Machine – Douglas O' Shaughnessy, 2nd Ed., EEE Press.
3. Digital Processing of Speech Signals L.R Rabinar and RW Schafer, 1978, PHI.

Reference Books
1. Discrete Time Speech Signal Processing: Principles and Practice – Thomas F. Quateri, 1st Ed., PE. 2. Speech & Audio Signal Processing – Ben Gold & Nelson Morgan, 1st Ed., Wiley.

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

CO1	Model an electrical equivalent of Speech Production system.
CO2	Extract the LPC coefficients that can be used to Synthesize or compress the speech
CO3	Design a Homomorphic Vocoder for coding and decoding of speech
CO4	Enhance the speech and can design an Isolated word recognition system using HMM
CO5	Can extract the features for Automatic speaker recognition system which can used for classification

IV-Year Semester **DIGITAL IC DESIGN** **(Professional Elective - 2)**

20PE4102

L	T	P	C
3	0	0	3

Pre-Requisites: Basic Knowledge on Digital Logic, VLSI Design and MOS Circuits

Course Objectives:

1. Understand CMOS logic and basic combinational and sequential designs relevant to it
2. Analyze DC and transfer characteristics of basic CMOS structure and identify various effect such as Channel Length Modulation.
3. Formulate gate sizing and logical effort to develop CMOS circuits by compromising delay and power.
4. Implement the concept of logical effort and develop the combinational circuits with dynamic issues into consideration.
5. Build sequential circuits with a proper analysis over delay constraints.

UNIT I

CMOS Logic and Circuit Design: The Inverter, CMOS Logic Gates, Compound Gates, Static CMOS Logic. Ratioed Logic, Cascode Voltage Switch Logic, Dynamic CMOS Circuits, Pass Transistors and Transmission Gates, Tristates, Multiplexers, Sequential Circuits

UNIT I

MOS Transistor Theory: MOS Structure and Operation, Regions of Operation, Long Channel I-V Characteristics, Simple CMOS Capacitance Models, Nonideal I-V Characteristics, Channel Length Modulation, Threshold Voltage Effects, Leakage, DC Characteristics.

UNIT III

CMOS Delay and Power: Delay Definitions, RC Delay Model, Gate Sizing, Linear Delay Model: Logical Effort, Parasitic Delay, Delay in a Logic Gate. Limitations to the Linear Delay Model, Logical Effort of Paths, Limitations of Logical Effort, Sources of Power Dissipation, Dynamic Power, Short Circuit, Leakage Power

UNIT-IV

Combinational Circuit Design: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass-transistor Circuits. Charge leakage, Charge Sharing, Hot Spots, Minority Carrier Injection, Back-Gate Coupling. Design Examples: Introduction to Datapath Sub-systems, Binary Adder, Full Adder, Carry Skip Adder

UNIT-V

Sequential Circuit Design: Introduction, Sequencing Methods, Max-Delay Constraints, Min-Delay Constraints, Time Borrowing, Clock Skew, Metastability, Master-slave flip flop and timing parameters, Design Examples: Binary Counters, Fast Binary Counters, Ring and Johnson Counters, Linear-feedback Shift Registers.

Text Books

1. Niel H. E. Weste and David M Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", (4/e), Pearson, 2011.
2. J. M. Rabaey, A. Chandrakasan and B. Nikolic, "Digital Integrated Circuits", Prentice Hall, (2/e), 2003.
3. K. Eshraghian, D. A. Pucknell and S. Eshraghian, Essentials of VLSI Circuits and Systems, Prentice-Hall of India Private Limited, 2005.

Reference Books

1. S. Kang and L. Yusuf, "CMOS Digital Integrated Circuits", (3/e),McGraw-Hill, 2003

Online References:

1. An online course "Digital IC Design", NPTEL, by Prof. Janakiram https://nptel.ac.in/courses/108106158.

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

CO1	Understand CMOS logic and relevant combinational and sequential logic circuits using them
CO2	Analyze the characteristics of CMOS designs and identify implicit effects such as channel length modulation etc.
CO3	Develop CMOS logic circuits by formulating gate sizing, logical efforts etc. to improve delay and power

CO4	Implement the concepts of gate sizing and logical efforts to design sequential circuits
CO5	Build sequential circuits by considering delay constraints

IV- Year-I Semester
20PE4103

FUNDAMENTALS OF NANOTECHNOLOGY
(Professional Elective – 3)

L	T	P	C
3	0	0	3

Pre-Requisites: Basic Knowledge on Material Science and Quantum Mechanics.

Course Objectives:

1. To understand the basic scientific concepts of Nano science.
2. To understand the properties of nano materials, characterization of materials, synthesis and fabrication.
3. To understand the applications of nano technology in various science, engineering and technology fields.

Unit I:

Introduction:

History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.

Unit II:

Properties Of Materials:

Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto-electronic properties. Effect of size reduction on properties, electronic structure of nano materials

Unit III:

SYNTHESIS AND FABRICATION:

Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures

Unit IV:

Characterization Techniques:

X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezo response microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse

reflectance spectra, photoluminescence spectra, Raman spectroscopy.
Unit V: **Carbon Nano Technology:** Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalline diamond films, grapheme, applications of carbon nano tubes. **Applications Of Nano Technology:** Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin fins, applications of quantum dots.

Text Books
1. Nano science and nano technology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers. 2. Nanotechnology by Jermy J Ramsden, Elsevier publishers.
Reference Books
1. Nano Materials- A.K.Bandyopadhyay/ New Age Introdu. 2. Nano Essentials- T.Pradeep/TMH. 3. Nanotechnology the Science of Small by M.A Shah, K.A Shah, Wiley Publishers. 4. Principles of Nanotechnology by Phani Kumar, Scitech.

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

CO1	Identify the essential concepts used in nanotechnology.
CO2	Identify the materials, properties, syntheses and fabrication, characterization and applications in various fields.
CO3	Understand and get familiar with fabrication process
CO4	Analyze different characterization techniques
CO5	Understand carbon Nano technology and its process

IV- Year-I Semester

20PE4103

SATELLITE COMMUNICATIONS
(Professional Elective – 3)

L	T	P	C
3	0	0	3

Pre-Requisites: Analog and Digital Communications, Antennas & Wave Propagation, Microwave Engineering

COURSE OBJECTIVES:

1. Acquire foundation in orbital mechanics and launch vehicles for the satellites.
2. Understand the various satellite subsystems and their functionalities.
3. Understand the concepts of satellite link design and calculation of C/N ratio, the concepts of multiple access and various types of multiple access techniques in satellite systems.
4. Familiarize the earth station technologies and the applications in earth segment.
5. Understand various satellite applications.

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	**Understand** the origin, basic concepts of satellite communications, **Categorize** look angles, and **Discuss** launches, launch vehicles and orbital effects in satellite communications
CO2	**Analyse** the various satellite subsystems and their functionalities.
CO3	**Evaluate** satellite link design and **Apply** the concepts of multiple access and various types of multiple access techniques in satellite systems.
CO4	**Explain** earth station technologies and earth segment.
CO5	**Describe** the services rendered by satellite and its applications.

UNIT-I: (14 Hours)

INTRODUCTION: Evolution of Satellite Communications, Basic Elements of Satellite Communication Systems, Frequency Allocations for Satellite Services, Applications and Future Trends of Satellite Communications.

ORBITAL MECHANICS: Kepler's Laws of Planetary Motion, Orbital Perturbations and Station Keeping, Determination of Satellite Orbits, Footprint, Look Angles, Elevation Angles, Launches and Launch Vehicles, Orbital Effects in Communication Systems Performance.

UNIT-II: (10 Hours)

SATELLITE SUBSYSTEMS: Attitude and Orbit Control System (AOCS), Telemetry, Tracking, Command and Monitoring System (TTC&M), Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification.

UNIT-III: (15 Hours)

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.

SATELLITE ACCESS: Types of Multiple Accesses, FDMA Concepts – Inter Modulation and Back Off – SPADE System, TDMA Concepts – Frame and Burst Structure, CDMA Concepts, Comparison of Multiple Access Schemes.

UNIT-IV: (12 Hours)

EARTH STATION TECHNOLOGY: Introduction, Earth Station Subsystems, Tracking Systems, Terrestrial Interface, Primary Power Test Methods.

EARTH SEGMENT: Receive Only Home TV Systems – Outdoor Unit – Indoor Unit for Analog (FM) TV, Direct to Home Broadcast (DTH), Master Antenna TV System (MATV), Community Antenna TV System (CATV), Transmit – Receive Earth Stations.

UNIT-V: (13 Hours)

SATELLITE APPLICATIONS: Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) Satellite Systems, INTELSAT Series, INSAT Series, VSAT, Global System for Mobile Communications (GSM), Global Positioning System (GPS) INMARSAT, GRAMSAT, Specialized Services – E mail, Video Conferencing, Internet. Nano Satellites.

Text Books

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Ed., 2003.

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

3. Satellite Communications – Dennis Roddy, McGraw Hill, 4th Ed., 2009.

Reference Books

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Ed., 2003.

2. Satellite Communication Systems Engineering – Pritchend and Sciulli, PHI Learning, 1986.

3. Satellite Communication – Robert M. Gagliendi, John Wiley and Sons, 1988.

Online References:

1. https://onlinecourses.nptel.ac.in/noc17_ec14
2. https://www.coursera.org/learn/satellite-communications
3. https://www.class-central.com/tag/satellite%20communications
4. https://ep.jhu.edu/programs-and-courses/525.440-satellite-communications-systems

IV-Year-I Semester
20PE4103

NPTEL/SWAYAM MOOCS
(Professional Elective – 3)

L	T	P	C
3	0	0	3

IV- Year-I Semester

20PE4103

INTRODUCTION TO MEMS & NEMS

(Professional Elective – 3)

L	T	P	C
3	0	0	3

Pre-Requisites: Fundamentals of Mechanicals

Course Objectives:

1. Understand the fundamental concepts of MEMS and NEMS.
2. Grasp the principles of fabrication and design of micro and nanoscale devices.
3. Analyze the applications and challenges associated with MEMS and NEMS technologies.
4. Apply knowledge of MEMS and NEMS in solving real-world problems.
5. Appreciate the significance of micro and nanoscale systems in various industries.

Unit I: Introduction to MEMS and NEMS

Definition and significance of MEMS and NEMS, Historical overview and development of micro and nanoscale systems, Comparison between MEMS and NEMS technologies, Importance of miniaturization and scaling effects

Unit II: Microfabrication Techniques

Overview of microfabrication processes (lithography, etching, deposition, etc.), photolithography and mask fabrication, Wet and dry etching techniques, Thin film deposition methods (CVD, PVD, ALD, etc.).

Unit III: MEMS/NEMS Design and Modelling

Design considerations for micro and nanoscale systems, Mechanical modelling and simulation of micro/nanostructures, Scaling laws and challenges in micro/nano design, Design optimization and trade-offs

Unit IV: MEMS/NEMS Devices and Applications

Accelerometers, gyroscopes, and other MEMS sensors, Microfluidic devices and lab-on-a-chip systems, MEMS actuators and their applications, NEMS resonators and oscillators.

Unit V: Emerging Trends and Challenges

Energy harvesting using MEMS/NEMS, MEMS/NEMS in biomedical applications, Integration of MEMS/NEMS with electronics, Challenges in fabrication, packaging, and reliability.

Text Books

1. "Fundamentals of Microfabrication and Nanotechnology" by Marc J.

Madou.
2. "Introduction to Microfabrication" by Sami Franssila.
3. "MEMS and Microsystems: Design and Manufacture" by Tai-Ran Hsu.

Reference Books

1. "Nanoelectromechanical Systems" by Sergey Edward Lyshevski.
2. "MEMS and NEMS: Systems, Devices, and Structures" by Sergey Edward Lyshevski.

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

CO1	**Foundational Knowledge:** Understand the foundational concepts of MEMS and NEMS.
CO2	**Fabrication Expertise:** Grasp the principles of microfabrication and design of micro/nano devices.
CO3	**Applications Analysis:** Analyze the applications and potential of MEMS and NEMS technologies.
CO4	**Problem Solving:** Apply knowledge of MEMS and NEMS to solve real-world engineering challenges.
CO5	**Industry Relevance:** Appreciate the significance of micro/nanoscale systems in various industries.

IV- Year-I Semester

20PE4104

DIGITAL IMAGE PROCESSING

(Professional Elective – 4)

L	T	P	C
3	0	0	3

Pre-Requisites: Signals & Systems, Digital Signal Processing

COURSE OBJECTIVES:

1. Familiarize with basic concepts of digital image processing and different image transforms
2. Learn various image processing techniques like image enhancement both in spatial and frequency domain
3. Familiarize with basic restoration techniques
4. Understand segmentation and morphological techniques applicable to various tasks
5. Familiarize with few computers vision techniques

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	**Perform** image manipulations and different digital image transform techniques. **{Understanding level, KL2}**
CO2	**Apply** various spatial and frequency domain techniques for the smoothing and sharpening of images. **{Applying level, KL3}**
CO3	**Describe** various image restoration techniques. **{Understanding level, KL2}**
CO4	**Apply** various segmentation and morphological operators on images. **{Applying level, KL3}**
CO5	**Analyze** different computer vision techniques. **{Analysing level, KL4}**

UNIT-I: (15 Hours)

FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS

Introduction, Image sampling, Quantization, Resolution, Elements of image processing system, Applications of Digital image processing. Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier

transform, Discrete cosine transform, Walsh transform, Hadamard transform, Haar transform, slant transform and KL transform.

UNIT-II: (12 Hours)

IMAGE ENHANCEMENT

Spatial domain methods: Point & Histogram processing, Fundamentals of Spatial filtering, smoothing spatial filters, Sharpening spatial filters.

Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

UNIT-III: (12 Hours)

IMAGE RESTORATION AND RECONSTRUCTION

A model of the image degradation and Restoration process, Noise models, Restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter.

UNIT-IV: (12 Hours)

IMAGE SEGMENTATION

Fundamentals, point, line, edge detection, thresholding, and region –based segmentation.

MORPHOLOGICAL IMAGE PROCESSING

Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning.

UNIT-V: (12 Hours)

INTRODUCTION TO COMPUTER VISION:

Introduction to patterns and pattern classes-supervised learning, unsupervised learning, Reinforced learning, stages of pattern recognition design cycle, template matching, introduction to classification, statistical methods, evaluation of classifier algorithms.

Text Books

1. Digital Image Processing – Gonzalez and Woods, 2nd Ed., Pearson.
2. S. Jayaraman, S. Esakkirajan and T. VeeraKumar, "Digital Image processing, Tata McGraw Hill publishers, 2009

Reference Books

1. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. J. T. Tou, R. C. Gonzalez, "Pattern Recognition Principles", Addison-Wesley, 1974.
3. B. Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009

E-Resources & other digital material:

NPTEL Lecture material

1. Lecture Series on Digital Image Processing by Prof. P. K. Biswas, Department of Electrical& Electronic Communication Engineering,IIT Kharagpur.https://www.youtube.com/playlist?list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8

IV- Year-I Semester
20PE4104

WIRELESS SENSOR NETWORKS
(Professional Elective – 4)

L	T	P	C
3	0	0	3

Pre-Requisites: Basic Knowledge on Basic Electronics and Sensor Technologies

Course Objectives:

1. To understand the characteristics, basic concepts in Wireless sensor networks
2. To understand the architecture framework and goals of WSN
3. To understand the Medium Access control and its protocols

Unit I:

OVERVIEW OF WIRELESS SENSOR NETWORKS:

Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints an challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

Architectures:

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts

Unit II:

Networking Technologies:

Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

Unit III:

MAC Protocols for Wireless Sensor Networks:

Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols

Unit IV:

Routing Protocols:

Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols, Proactive Routing

Unit V:

Transport Layer and Security Protocols:

Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks.

Security in WSN and Applications of WSNs:

Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Sensor Node Hardware

Applications of WSNs:

S Ultra-wide band radio communication, Wireless fidelity systems. Future directions, home automation, smart metering Applications

Text Books

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani, CRC Press
3. Holger Karl & Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks" John Wiley, 2005.

Reference Books

1. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer
2. Wireless Sensor Networks – S Anandamurugan , Lakshmi Publications.

3. Kazem Sohraby, Daniel Minoli, & Taieb Znati,"Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.

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

CO1	Able to identify the components of a WSN, including sensors, communication modules, and data processing units.
CO2	Able to design and deploy wireless sensor networks by selecting appropriate sensor nodes, configuring communication protocols.
CO3	Analyze challenges in wireless sensor networks, such as energy efficiency, data synchronization, network scalability.
CO4	Demonstrate a comprehensive understanding of wireless sensor technologies, including the fundamental principles of sensing, data acquisition
CO5	Able to identify the security issues in different layers

IV- Year-I Semester **RF INTEGRATED CIRCUITS**
20PE4104 (Professional Elective – 4)

L	T	P	C
3	0	0	3

Pre-Requisites: Basic Knowledge on RLC Circuits concepts

Course Objectives:

1. To define basic architecture RF systems, different RLC Circuits and transmission media
2. To understand Frequency synthesis and oscillators and GSM radio architectures, CDMA, UMTS radio architectures.
3. To understand the LNA Design and the different design examples & Multiplier based mixers.

Unit I:

Introduction to RF systems – basic architectures, Transmission media and reflections, Maximum power transfer , Passive RLC Networks, Parallel RLC tank, Q, Series RLC networks, matching, Pi match, T match, Passive IC Components Interconnects and skin effect, Resistors, capacitors Inductors

Unit II:

Review of MOS Device Physics - MOS device review, Distributed Systems, Transmission lines, reflection coefficient, the wave equation, examples, Lossy transmission lines, Smith charts – plotting Gamma, High Frequency Amplifier Design, Bandwidth estimation using open-circuit time constants, Bandwidth estimation, using short-circuit time constants, Rise time, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers, Cascaded amplifiers

Unit III:

Noise - Thermal noise, flicker noise review, Noise figure, LNA Design, Intrinsic MOS noise parameters, large signal performance, design examples & Multiplier based mixers. Mixer Design, Subsampling mixers

Unit IV:

RF Power Amplifiers: Class A, AB, B, C amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples, Voltage controlled oscillators, Resonators, Negative resistance oscillators, Phase locked loops, Linearized PLL models, Phase detectors, charge pumps, Loop filters, and PLL design examples.

Unit V:

Frequency synthesis and oscillators, Frequency division, integer-N synthesis, Fractional frequency, synthesis, Phase noise, General considerations, and Circuit examples, Radio architectures Power match versus, noise match, GSM radio architectures, CDMA, UMTS radio architectures

Text Books

1. Pearson "RF Circuit Design Theory And Application" - Reinhold Ludwig
2. "Fundamentals of Microwave and RF Design" Michael Steer
3. The design of CMOS Radio frequency integrated circuits by Thomas H. Lee Cambridge university press, 2004.

Reference Books

1. "Transistor Level Modeling for Analog/RF IC Design" by Wladyslaw Grabinski and Bart Nauwelaers.
2. "Advances in Analog and RF IC Design for Wireless Communication Systems" by Gabriele Manganaro and Domine M W Leenaerts.
3. "RF System Design of Transceivers for Wireless Communications" by Qizheng Gu
4. "Microwave and RF Design: A Systems Approach (Electromagnetic Waves)" by Michael Steer.

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

CO1	Understand passive components at RF frequencies and required circuit theory
CO2	Design high frequency amplifiers and low noise amplifiers
CO3	Compare different types of mixers
CO4	Analyze oscillators and synthesizers at RF frequencies
CO5	Able design specific applications using Different modules like GSM CDMA

IV- Year-I Semester **COMPUTER NETWORKS**
20PE4105 (Professional Elective – 5)

L	T	P	C
3	0	0	3

Pre-Requisites: Basic Knowledge on Operating Systems and Programming

Course Objectives:

1. To provide insight about networks, topologies, and the key concepts.
2. To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
3. To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
4. To know the basic concepts of network services and various network applications

.

Unit I:

Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP.

Reference Model – A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP, Lack of OSI models success, Internet History.

Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and unguided media: Wireless-Radio waves, microwaves, infrared

Unit II:

Data link layer: Design issues, Framing: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, Elementary Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.

Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field, point to point protocol (PPP): framing transition phase, multiplexing, multilink PPP

Unit III:

Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, Controlled Access: Reservation, Polling, Token Passing, Channelization: frequency division multiple Access(FDMA), time division

multiple access(TDMA), code division multiple access(CDMA).

Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet

Unit IV:

The Network Layer Design Issues – Store and Forward Packet Switching- Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.

Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, NAT-, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6- Internet control protocols- ICMP-ARPDHCP.

Unit V:

The Transport Layer - Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services TCP features-Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.

Application Layer - World Wide Web: HTTP, Electronic mail-Architecture-web-based mail- email security- TELENET-local versus remote Logging-Domain Name System: Name Space, DNS in Internet,- Resolution-Caching-Resource Records- DNS messages- Registrars-security of DNS Name Servers, SNMP

Text Books

1. Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan, Fifth

Edition TMH.
Reference Books
1. Data Communications and Networks- Achut S Godbole, Atul Kahate 2. Computer Networks, Mayank Dave, CENGAGE.

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

CO1	Demonstrate different network models for networking links OSI, TCP/IP, B-ISDN, N-BISDN and get knowledge about various communication techniques, methods and protocol standards.
CO2	Analyze data link layer services, functions and protocols like HDLC and PPP.
CO3	Compare and Classify medium access control protocols like ALOHA, CSMA, CSMA/CD, CSMA/CA, Polling, Token passing, FDMA, TDMA, CDMA protocols
CO4	A Determine application layer services and client server protocols working with the client server paradigms like WWW, HTTP, FTP, e-mail and SNMP etc.
CO5	Analyze data link layer services, functions and protocols like HDLC and PPP.

IV- Year-I Semester

20PE4105

MOBILE CELLULAR COMMUNICATION
(Professional Elective – 5)

L	T	P	C
3	0	0	3

Pre-Requisites: Analog and Digital Communication

COURSE OBJECTIVES:

1. To know the basic cellular concepts and elements of cellular system design.
2. To classify the types of interferences and cell coverage for signal and traffic at various environments.
3. To illustrate the frequency management, channel assignment, types of handoffs and dropped calls.
4. To understand digital cellular systems.
5. To interpret modern cellular technologies.

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	**Know** inner workings of cellular system and **describe** the elements of cellular systems.
CO2	**Categorize** different interferences and **Analyze** cell coverage for signal and traffic in various environments.
CO3	**Distinguish** the frequency management and channel assignments in cellular system and **understand** the handoffs in cellular systems
CO4	**Determine** digital cellular systems.
CO5	**Interpret** advancement in modern cellular technologies.

UNIT-I: (15 Hours)

INTRODUCTION TO CELLULAR MOBILE RADIO SYSTEMS: Limitations of conventional mobile telephone systems, basic cellular mobile system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning of cellular system, hexagonal shaped cells, trunking efficiency

ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN: concept of frequency

reuse channels, co channel interference reduction factor, desired C/I from a normal case in a omni directional antenna system, handoff mechanism, cell splitting, cellular structures: macro, micro, pico and femto cells.

UNIT-II: (14 Hours)

INTERFERENCE: Types of interferences, introduction to co channel interference, antenna parameters and their effects, diversity receiver, non-co channel interference-different types.

CELL COVERAGE FOR SIGNAL AND TRAFFIC: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, general formula for mobile propagation over water and flat open area, foliage losses, near and long-distance propagation, Antenna height gain effects, path loss from a point-to-point prediction model in different conditions.

UNIT-III: (17 Hours)

FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT: Numbering and grouping of channels, fixed channel and non-fixed channel assignment.

HANDOFFS AND DROPPED CALLS: Concept of handoff, handoff initiation, types of handoffs, probability of handoff, vehicle locating methods, introduction to dropped call rates and their evaluation.

UNIT-IV: (10 Hours)

INTRODUCTION TO DIGITAL CELLULAR SYSTEMS: Digital Mobile Telephony, High capacity FSK in FDMA, TDMA, Spread Spectrum Modulation, CDMA, OFDMA, GSM architecture, GSM channels.

UNIT-V: (09 Hours)

MODERN CELLULAR TECHNOLOGIES: Architecture of 3G cellular systems,3G and 4G Wireless Standards, LTE architecture, Rationale of 5G, 5G use cases and its requirements.

Text Books

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2nd Edn.,2006.

2. AfifOsseiran, Jose.F.Monserrat, Patrick Marsch, “Fundamentals of 5G MobileNetworks” , Cambridge University Press.

3. Advanced Wireless Communications-4G By. Savo G Glisic, John Wiley & Sons

Publication 2ndEdition

Reference Books

1. Wireless Communications - Theodore. S. Rapport, Pearson education, 2nd Edn., 2002.

2.Wireless and Mobile Communications – Lee McGraw Hills, 3rd Edition, 2006.

3. Mobile Cellular Communication – G Sasibhushana Rao, Pearson

4. Wireless Communication and Networking – Jon W. Mark and WeihuaZhqung, PHI, 2005.

5. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.

6. Fundamentals of Wireless Communication-David Tse and Pramod Viswanath,Cambridge UniversityPress

E-Resources & other digital material:

NPTEL Lecture material

1. Lecture Series on Wireless Communication by Dr. Ranjan Bose, Department of Electrical Engineering, IIT Delhi.
2. http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/EC632.pdf
3. http://accessengineeringlibrary.com/browse/wireless-and-cellular-communications-third-edition

IV- Year-I Semester

20PE4105

ADVANCED DIGITAL SIGNAL PROCESSING
(Professional Elective – 5)

L	T	P	C
3	0	0	3

Pre-Requisites: Digital Signal Processing

Course Objectives:

1. Understand advanced concepts and techniques in digital signal processing.
2. Analyze and design complex signal processing algorithms.
3. Apply advanced DSP methods to various real-world applications.
4. Evaluate the performance of advanced DSP algorithms in different scenarios.
5. Explore emerging trends and developments in DSP.

Unit I: Advanced Signal Transformations

Discrete Wavelet Transform (DWT) and its applications, Multirate signal processing and polyphase structures, Filter banks and their role in advanced signal analysis, Fast algorithms for DFT and FFT

Unit II: Adaptive Signal Processing

Least Mean Squares (LMS) algorithm and its variants, Recursive Least Squares (RLS) algorithm, Kalman filtering for estimation and tracking, Blind source separation and Independent Component Analysis **(ICA).**

Unit III: Spectral Estimation and Modeling

Parametric methods for spectral estimation (AR, MA, ARMA), Non-parametric methods: Periodogram, Welch method, and Bartlett method, Model order selection and Akaike Information Criterion (AIC), Higher-order statistics and time-frequency analysis

Unit IV: Statistical Signal Processing

Random signals and processes, Linear prediction and Levinson-Durbin recursion, Wiener and Wiener-Kolmogorov filtering, Signal detection and estimation theory.

Unit V: Advanced DSP Applications

Speech and audio processing beyond basic filtering, Image and video processing: compression and restoration techniques, Radar and sonar signal processing, Bioinformatics and biomedical signal processing

Text Books

1. Digital Signal Processing: Principles, Algorithms, and Applications" by

John G. Proakis and Dimitris G. Manolakis.
2. "Statistical Digital Signal Processing and Modeling" by Monson H. Hayes.
3. "Adaptive Filter Theory" by Simon Haykin

Reference Books

1. "Wavelets and Filter Banks" by Gilbert Strang and Truong Nguyen.
2. "Advanced Digital Signal Processing: Theory and Applications" by Dingyu Xue and YangQuan Chen.

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

CO1	Demonstrate different network models for networking links OSI, TCP/IP, B-ISDN, N-BISDN and get knowledge about various communication techniques, methods and protocol standards.
CO2	Analyze data link layer services, functions and protocols like HDLC and PPP.
CO3	Compare and classify medium access control protocols like ALOHA, CSMA, CSMA/CD, CSMA/CA, Polling, Token passing, FDMA, TDMA, CDMA protocols
CO4	A Determine application layer services and client server protocols working with the client server paradigms like WWW, HTTP, FTP, e-mail and SNMP etc.
CO5	Analyze data link layer services, functions and protocols like HDLC and PPP.

IV- Year-I Semester **LOW POWER VLSI DESIGN**
20PE4105 (Professional Elective – 5)

L	T	P	C
3	0	0	3

Pre-Requisites: Analog Circuit 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.

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:

Supply Voltage Scaling for Low Power: Device Feature Size Scaling, Constant-Field Scaling, Constant-Voltage Scaling, Architectural-Level Approaches: Parallelism for Low Power, Pipelining for Low Power, Combining Parallelism with Pipelining, Voltage Scaling Using High-Level Transformations: Multilevel Voltage Scaling Challenges in MVS Voltage Scaling Interfaces, Static Timing Analysis Dynamic Voltage and Frequency Scaling

UNIT -III

Low-Power Design Approaches: Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and
Parallel Processing Approaches. Power Gating, Clock Gating Versus Power Gating, Power Gating Issues, Isolation Strategy, State Retention Strategy, Power-Gating Controller, Power Management, Combining DVFS and Power Management.

UNIT -IV:

Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's 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 Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh- Wooley 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, Pre-charge 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-Mo Kang, Yusuf Leblebici, TMH,2011.
2. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH ProfessionalEngineering,1st edition,2004

Reference Books

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRCPress,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, Kluwer Academic Press,2002.
4. Leakage in Nanometer CMOS Technologies– Siva G. Narendran, Anatha Chandrakasan, Springer,2005

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

CO1	Understand the need of Low power circuit design.
CO2	Attain the knowledge of architectural approaches.
CO3	Analyze and design Low-Voltage Low-Power combinational circuits.
CO4	Understand Low power design approaches
CO5	Known the design of Low-Voltage Low-Power Memories

IV- Year-I Semester
20OE4103

MACHINE LEARNING
(Open Elective – 3)

L	T	P	C
3	0	0	3

Pre-Requisites: Probability and statistics

COURSE OBJECTIVES:

1. Familiarity with a set of well-known supervised, unsupervised and semi-supervised learning algorithms.
2. Understanding the machine learning model prediction through classification, scoring and ranking
   using R.
3. Predict objects classification through decision tree building and rule building.
4. Know the importance of features and perform feature engineering
5. Summarizing the data from large tables into smaller set of summary indices through principal component analysis

UNIT-I

Introduction to Statistical Learning: What Is Statistical Learning, Assessing Model Accuracy. Linear Regression: Simple Linear Regression, Estimating the Coefficients, Assessing the Accuracy of the Coefficient Estimates, Assessing the Accuracy of the Model

UNIT-II

Multiple Linear Regressions: Estimating the Regression Coefficients, Other Considerations in the Regression Model, Comparison of Linear Regression with K-Nearest Neighbours. **Classification:** An Overview of Classification, Why Not Linear Regression, Logistic Regression, Generative Models for Classification, A Comparison of Classification Methods

UNIT-III

Resampling Methods: Cross-Validation, the Bootstrap.

Linear Model Selection and Regularization, Subset Selection, Shrinkage Methods, Dimension Reduction Methods, Considerations in High Dimensions

UNIT- IV:

Tree-Based Methods: The Basics of Decision Trees, Regression Trees, Classification Trees, Trees Versus Linear Models, Advantages and Disadvantages of Trees, Bagging, Random Forests, Boosting and Bayesian Additive Regression Trees.

UNIT-V:

Support Vector Machines, Maximal Margin Classifier, Support Vector Classifiers, Support Vector Machines.

Unsupervised Learning: The Challenge of Unsupervised Learning, Principal Components Analysis, Missing Values and Matrix Completion, Clustering Methods

Text Books

1. EthemAlpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.

2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar "Foundations of Machine Learning", MIT Press, 2012

3. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012

Reference Books

1. Chris Albon: Machine Learning with Python Cookbook, O'Reilly Media, Inc.2018.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, CRC Press, 2015.
4. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012 Jiawei Han and Micheline Kambers and Jian Pei, "Data Mining –Concepts and Techniques", 3rd Edition, Morgan Kaufman Publications, 2012.
5. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2019.

Online resources:

1. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012, https://www.cs.ubc.ca/~murphyk/MLbook/pml-intro-5nov11.pdf.

2. Professor S. Sarkar, IIT Kharagpur "Introduction to machine learning", https://www.youtube.com/playlist?list=PLYihddLFCgYuWNL55Wg8ALkm6u8U7gps.

3. Professor Carl Gustaf Jansson, KTH, Video Course on Machine Learning https://nptel.ac.in/noc/individual_course.php?id=noc19-cs35.

4. Tom Mitchell, "Machine Learning", http://www.cs.cmu.edu/~tom/10701_sp11/lectures.shtml

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	Explain the differences among the three main styles of learning: reinforcement learning, supervised, and unsupervised learning.
CO2	Implement the algorithms for supervised learning and unsupervised learning using R.
CO3	Determine which of the three learning styles is appropriate to a particular problem domain.
CO4	Be able to work with real-world data and perform machine learning through data analytics
CO5	Characterize the state of the art in learning theory, including its achievements and its challenges.

IV- Year-I Semester

20OE4103

INDUSTRIAL AND MEDICAL INTERNET OF THINGS
(Open Elective – 3)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Perform effectively as entry level Embedded Systems professionals.
2. Develop and maintain applications written using Embedded C.
3. Independently design and develop a hardware platform encompassing a microcontroller and peripherals

UNIT-I: Introduction to Industrial IoT

Technical requirements, IoT background-History and definition, IoT enabling factors, IoT applications, IoT key technologies, I-IoT, IoT and I-IoT – similarities and differences, Industry environments and scenarios covered by I-IoT.

UNIT-II: Understanding the Industrial Process and Devices Technical requirements

The industrial process-Automation in the industrial process, Control and measurement systems, Types of industrial processes.

UNIT-III: Industrial Data Flow and Devices

Technical requirements, The I-IoT data flow in the factory , Measurements and the actuator chain .Sensors , The converters - Digital to analogical , Analog to digital, Actuators, Controllers - Microcontrollers, Embedded microcontrollers , Microcontrollers with external memory, DSP's. Industrial protocols -Automation networks, The fieldbus, Developing Industrial IoT and Architecture Introduction to the I-IoT platform and architectures, OSGi, micro service, containers, and server less computing, The standard IIoT flow.

UNIT-IV: Internet of Medical Things Introduction and system architecture

Introduction, IoMT Devices-On-Body Devices, In Home Devices, Community Devices, In-Clinic Devices, In Hospital Devices ,IoMT System Architecture-Data Collection Layer, Data Management Layer, Medical Server Layer

UNIT-V: Internet of Medical Things Security Threats, Security Challenges and Potential Solutions

IoMT Attack Types, Challenges in IoMT Security Schemes, Current Security Plans for IoMT, Potential Solutions for Security Vulnerabilities.

Text Books

1. Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of

Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1stEd., Packt Publishing Ltd, 2018.

2. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus

Reference Books

1. Alasdair Gilchrist- Industry 4.0: The Industrial Internet of Things, 1st Ed., Apress, 2017.
2. Reis, Catarina I., and Marisa da Silva Maximiano, eds.- Internet of Things and advanced application in Healthcare, 1st Ed., IGI Global, 2016

Online resources:

1. https://www.coursera.org/specializations/developing-industrial-iot#courses
2. https://www.coursera.org/learn/industrial-internet-of-things.
3. https://www.coursera.org/learn/internet-of-things-sensing-actuation

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	Understand the basics of Industrial IOT and Medical IOT
CO2	Identify the technical and industrial requirement procedures for IIOT applications
CO3	Develop various applications using IIOT architectures
CO4	Choose selected IOT devices for understanding the system architecture of medical IOT
CO5	Analyze privacy and security measures for industry and medical standard solutions

IV- Year-I Semester

20OE4103

MARKETING MANAGEMENT
(Open Elective – 3)

L	T	P	C
3	0	0	3

Pre-Requisites: Basic Sciences and Humanities

COURSE OBJECTIVES:

1. To familiarize with the basic concepts, and techniques of marketing management
2. To understand the behavior of consumers
3. To create awareness of marketing mix elements, and
4. To analyze and solve marketing problems in the complex and fast changing business environment.
5. To Outline key marketing Concepts and enable a student to take up marketing as a career

UNIT-I: (12 Hours)

INTRODUCTION TO MARKETING:

Concepts of Marketing and Marketing Management, Marketing Concepts - Marketing Process, Marketing mix - Marketing environment. - Consumer Markets and buying behavior - Market segmentation and targeting and positioning.

UNIT-II: (12 Hours)

PRODUCT DECISIONS:

Concept of a Product - Product mix decisions - Brand Decision - New Product Development – Sources of New Product idea - Steps in Product Development - Product Life Cycle strategies- Stages in Product Life Cycle.

UNIT-III: (12 Hours)

PRICE DECISIONS:

Pricing objectives - Pricing policies and constraints - Different pricing method - New product pricing, Product Mix pricing strategies and Price adjustment strategy.

UNIT-IV: (12 Hours)

CHANNEL DECISIONS:

Nature of Marketing Channels –. Types of Channel flows - Channel functions - Functions of Distribution Channel – Structure and Design of Marketing Channels -Channel co-operation, conflict and competition – Retailers and wholesalers.

UNIT-V: (12 Hours)

PROMOTION DECISION:

Promotion mix - Advertising Decision, Advertising objectives - Advertising and Sales Promotion – Developing Advertising Programme – Role of Media in Advertising - Advertisement effectiveness - Sales force Decision.

Text Books

1. Marketing Management (Analysis, Implementation & Control) – Philip Kotler
2. Fundamentals of Marketing – William J. Stanton & Others
3. Marketing Management – V.S. Ramaswamy and S. Namakumari
4. Marketing Research – Rajendra Nargundkar

Reference Books

6. K.S. Chandra sekar, Marketing Management Text and Cases, Tata McGraw-Hill Publication, New Delhi.2010
7. Govindarajan, Marketing Management Concepts, Cases, Challenges and Trends, Prentice Hall of India, New DelhI. 2009
8. Philip Kotler, Marketing Management- Analysis Planning and Control, Prentice Hall of India, New Delhi,
9. Rama swamy. V S & Nama kumari. S, Marketing Management-Planning Implementation and Control, Macmillan Business Books, New Delihi, 2002

ONLINE & WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg51/preview
2. https://www.edx.org/course/marketingmanagement?index=product&queryID=d757b8fcf377fb56ab5f232913 737553&position=1
3. https://www.edx.org/course/marketing-management2?index=product&queryID=3f97462d431d5de04821d99a5a8ce238&position=2
4. https://www.udemy.com/course/event-marketing-how-to-create-a-successful-event-series/

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	Acquaint with tools essential to creating, and evaluating marketing activities. (K2)
CO2	Demonstrating the key techniques used for marketing new products. (K6)
CO3	Developing the process of strategic decision-making for effective Pricing of Products. (K6)
CO4	Study and selecting the right marketing channels in order to meet strategic objectives. (K3)
CO5	Developing a holistic perspective of different marketing land Scape (K6)

IV-Year-I Semester

20OE4103

ADVANCED JAVA PROGRAMMING
(Open Elective – 3)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart the knowledge on collection framework.
2. To make the students to develop network-based applications.
3. To introduce XML and processing of XML Data with Java.
4. To introduce Server-side programming with Java Servlets and JSP

UNIT-I

The Collections Framework (java.util)- Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hash table, Properties, Stack, Vector.

UNIT-II

Introduction to Networking: Basics of Networking, Networking classes and Interfaces, Networking with URLs, exploring java.net package.

JDBC Connectivity: JDBC connectivity, types of Jdbc Drivers, connecting to the database, JDBC Statements, JDBC Exceptions, Manipulations on the database

UNIT-III

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets;

XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemas, Document Object Model, and Extensible Style sheet Language and XSL Transformations, Parsing XML Data – DOM and SAX Parsers in java

UNIT- IV

Introduction to Servlets: Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions.

UNIT-V

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking.

Text Books
1. Java: The Complete Reference, Herbert Schildtz, MC GRAW HILL Education, 9th Edition, 2016 2. Internet and World Wide Web – How to program, Dietel and Nieto, Pearson. 3. Java Server Pages –Hans Bergsten, SPD O'Reilly.
Reference Books
1. Chris Bates, "Web Programming, building internet applications", 2ndEdition, WILEY, Dreamtech, 2008. 2. Thomas A Powel, "The Complete Reference: AJAX", 1st Edition, Tata McGraw Hill, 2008. 3. Web Technologies, Uttam K Roy, Oxford University Press

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	Use various data structures using java collections.
CO2	Comprehend the trade-offs of implementation of priority queues.
CO3	Implement web-based applications using features of HTML and XML.
CO4	Appreciate the importance and significance of graph algorithms in building and solving real world applications.
CO5	Comprehend and implement algorithms for pattern matching in a text.

IV- Year-I Semester **OPERATING SYSTEMS**
20OE4104 (Professional Elective – 5)

L	T	P	C
3	0	0	3

Pre-Requisites: Digital Signal Processing

Course Objectives:

1. Study the basic concepts and functions of operating system
2. Learn about Processes, Threads and Scheduling algorithms
3. Understand the principles of concurrency and Deadlocks
4. Learn various memory management schemes
5. Study I/O management and File systems

UNIT-I

Introduction to Operating System Concepts: What Operating Systems do, Computer System Organization, Functions of Operating systems, Types of Operating Systems, Operating Systems Services, System calls, Types of System calls, Operating System Structures, Distributed Systems, Special purpose systems

UNIT-II

Process Management: Process concept, Process State Diagram, Process control block, Process Scheduling- Scheduling Queues, Schedulers, Scheduling Criteria, Scheduling algorithms and their evaluation, Operations on Processes, Inter-process Communication.

Threads: Overview, User and Kernel threads, Multi-threading Models

UNIT-III

Concurrency: Process Synchronization, The Critical- Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Monitors, and Classic Problems of Synchronization.

Principles of deadlock: System Model, Deadlock Characterization, Methods for Handling Deadlocks: Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock

UNIT- IV

Memory Management: Logical vs physical address space, Swapping, Contiguous Memory Allocation, Paging, Structures of the Page Table, Segmentation.

Virtual Memory Management: Virtual memory overview, Demand Paging, Page-Replacement & its algorithms, Allocation of Frames, Thrashing

UNIT-V

File system Interface: The concept of a file, Access Methods, Directory

structure, files sharing, protection.

File System implementation: File system structure, Allocation methods, and Free-space management.

Mass-storage structure: overview of Mass-storage structure, Disk scheduling, Swap space management

Text Books

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011

Reference Books

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata McGraw Hill Education.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhere, Second Edition, Tata McGraw-Hill Education

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

CO1	Understand the structure and functionalities of Operating System
CO2	Demonstrate the concept of Process, Threads and CPU Scheduling Algorithms
CO3	Use the principles of Concurrency to solve Synchronization problems various methods for handling Deadlocks
CO4	Infer various Memory Management Techniques
CO5	Illustrate File System Implementation

IV- Year-I Semester **COMPUTER VISION**
20OE4104 (Professional Elective – 5)

L	T	P	C
3	0	0	3

Pre-Requisites: Image Processing

Course Objectives:

1. Understand fundamental concepts in computer vision.
2. Analyze and process digital images and videos.
3. Design and implement computer vision algorithms for various applications.
4. Evaluate and compare different techniques in computer vision.
5. Apply computer vision techniques to real-world problems

Unit I: Introduction to Computer Vision

Definition and goals of computer vision, Historical overview and applications, Human vision vs. computer vision, Image representation and digital image fundamentals

Unit II: Image Processing and Analysis

Image enhancement techniques, Image filtering and convolution, Image segmentation and region-based techniques, Object detection and feature extraction, Image transformations and registration

Unit III: Feature Extraction and Description

Interest point detection and descriptors, Scale-space theory and blob detection, Edge detection and boundary representation, Texture analysis and classification

Unit IV: Image Recognition and Machine Learning in Computer Vision

Introduction to machine learning for computer vision, Supervised and unsupervised learning, Neural networks and deep learning architectures, Convolutional Neural Networks (CNNs) for image classification, Object recognition and scene understanding

Unit V: Motion Analysis and Video Processing

Optical flow and motion estimation, Tracking and object localization, Video stabilization and background subtraction, Action recognition and activity analysis

Text Books

1. "Computer Vision: Algorithms and Applications" by Richard Szeliski
2. "Computer Vision: Models, Learning, and Inference" by Simon J.D.

Prince
Reference Books
4. Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods 5. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

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

CO1	**Conceptual Grasp:** Understand the fundamental concepts and goals of computer vision.
CO2	**Image Manipulation:** Apply image processing techniques for image enhancement, segmentation, and analysis.
CO3	**Feature Analysis:** Extract and describe features from images for various applications.
CO4	**Machine Learning Integration:** Apply machine learning techniques, including deep learning, to computer vision tasks.
CO5	**Video Analysis:** Analyze and process video data for motion analysis and recognition.

IV- Year-I Semester **Advanced control systems** (Professional Elective – 5)
20OE4104

L	T	P	C
3	0	0	3

Pre-Requisites: Control systems

Course Objectives:

1. Understand advanced concepts in control systems beyond basic control theory.
2. Analyze complex control system architectures and designs.
3. Design advanced control strategies for different engineering applications.
4. Implement and evaluate control algorithms in various scenarios.
5. Apply control system techniques to solve real-world problems

Unit I: State Space Representation and Analysis
Introduction to state space representation, State space analysis and stability, Controllability and observability, State feedback and observer design.
Unit II: Multivariable and Optimal Control
Introduction to multivariable control systems, Decoupling and control of interacting systems, Introduction to optimal control, Linear Quadratic Regulator (LQR) design, Kalman filter for state estimation
Unit III: Nonlinear Control Systems
Introduction to nonlinear control systems, Lyapunov stability and control, Feedback linearization, Sliding mode control
Unit IV: Robust Control
Introduction to robust control, Uncertainty modeling in control systems, H-infinity control, Mu-synthesis
Unit V: Adaptive and Learning Control
Introduction to adaptive control, Model reference adaptive control, Self-tuning regulators, Reinforcement learning for control

Text Books
1. "Modern Control Systems" by Richard C. Dorf and Robert H. Bishop. 2. "Feedback Control of Dynamic Systems" by Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini
Reference Books
1. "Multivariable Feedback Control: Analysis and Design" by Sigurd Skogestad and Ian Postlethwaite. 2. "Nonlinear Control Systems" by Alberto Isidori

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

CO1	**Advanced Understanding:** Grasp advanced concepts of control systems, including state space representation and multivariable control.
CO2	**Design Complexity:** Design complex control strategies, considering optimality, robustness, and adaptability.
CO3	**Application Mastery:** Apply control algorithms to address nonlinear, uncertain, and adaptive control challenges.
CO4	**Evaluate Performance:** Analyze and evaluate the performance of advanced control strategies in real-world scenarios.
CO5	**Problem Solving:** Apply advanced control techniques to solve engineering problems and address emerging control challenges

IV- Year-I Semester 20OE4104	GREEN BUILDINGS (Open Elective – 4)	L	T	P	C
		3	0	0	3

Pre-Requisites: Basic knowledge of Building Components, Engineering Physics

COURSE OBJECTIVES:

1. This course aims to highlight importance of Energy- Efficient Buildings within the context of Energy issues in the 21st century.
2. To familiarize students with the concept of Energy efficiency, Renewable sources of energy and their effective adaptation in green buildings
3. To give a fuller understanding of Building Form and Fabric, Infiltration, ventilation, Lighting, cooling and water conservation.
4. To highlight the importance of Environmental Management as well as Environmental Impact Assessment methods in Energy efficient buildings.
5. To make students aware regarding various Green Building Certifications and Energy Conservation Building code

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	Understand why buildings should be made energy efficient
CO2	Have a fuller grasp on Renewable Energy mechanisms such as Passive Solar heating and collection, Photovoltaics, and Ground source heat pumps, and their adaption to green building concepts
CO3	Understand the concepts of Site and Climate,Building form,Building Fabric
CO4	Understand the concepts of Infiltration and ventilation, Lighting, Heating, Cooling, Energy Management and water conservation
CO5	Have the necessary skills to undertake an Environmental Impact Assessment study for Energy Efficient Buildings. They shall be equipped with the associated cutting-edge management strategies too

UNIT-I: (10 Hours)

Green Buildings within the Indian Context, Types of Energy, Energy Efficiency and Pollution, Better Buildings, Reducing energy consumption, Low energy design.

UNIT-II: (14 Hours)

Renewable Energy sources that can be used in Green Buildings – Conventional and Non-Conventional Energy, Solar energy, Passive Solar Heating, Passive Solar collection, Wind and other renewables. A passive solar strategy, Photovoltaics, Rainwater Harvesting Climate and Energy, Macro and Microclimate. Indian Examples

UNIT-III: (12 Hours)

Building Form – Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, Grouping of buildings. Building Fabrics- Windows and doors, Floors, Walls, Masonry, Ecological walling systems, Thermal Properties of construction material.

UNIT-IV: (15 Hours)

Infiltration and ventilation, Natural ventilation in commercial buildings, passive cooling, modelling air flow and ventilation, Concepts of daylight factors and day lighting, daylight assessment, artificial lighting, New light sources. Cooling buildings, passive cooling, mechanical cooling. Water conservation- taps, toilets and urinals, novel systems, collection and utilization of rain water.

UNIT-V: (13 Hours)

Energy awareness, monitoring energy consumption, Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED, GRIHA & IGBC Certification for buildings. Ecohomes, Sustainable architecture and urban design – principles of environmental architecture, Benefits of green buildings – Energy Conservation Building code – NBC-Case Studies – Green Buildings in Auroville and Dakshina Chitra, Tamil Nadu, India.

Text Books

1. William T. Meyer., Energy Economics and Building Design., New York: McGraw- Hill, Inc Indian Green Building Council

Reference Books

1. Public Technology, Inc. (1996). Sustainable Building Technical Manual: Green Building Design, Construction, and Operations. Public Technology, Inc., Washington, DC
2. Sim Van Der Ryn, Stuart Cowan, “Ecological Design”, Island Press (1996)
3. DiannaLopezBarnett,WilliamD.Browning,”APrimeronSustainableBuildin g”,RockyMountainGreenDevelopmentServices.
4. TheHOKGuidebooktoSustainableDesign,SaraMendlerandWilliamOdell,Joh nWiley.
5. DavidA.Gottfried,SustainableBuildingTechnicalManual.,PublicTechnologyI nc
6. RichardD.Rush,.BuildingSystemIntegrationHandbook.,NewYork:JohnWiley &Sons
7. BenFarmer&HentieLouw.,CompaniontoContemporaryArchitecturalThough t,London&NewPeterNoever(ed).,ArchitectureinTransition:BetweenDeconstr uctionandNewModernism.,Munich:Prestel

IV- Year-I Semester	IOT TOOLS AND APPLICATIONS	L	T	P	C
20SC4105	(Skill Advanced Course – 3)	1	0	2	2

Pre-Requisites:

1. Basic understanding of electronics and programming concepts
2. Familiarity with Python programming language
3. Basic knowledge of networking protocols

COURSE OBJECTIVES:

1. Recall the fundamental concepts of IoT and its various applications and explain the functioning of Raspberry Pi hardware and software.
2. Demonstrate the ability to interface sensors and actuators with Raspberry Pi for IoT projects.
3. Comprehensive understanding of cloud technologies and their practical applications in real-world scenarios.
4. Design, develop, and deploy a cloud-based application using a selected cloud platform.
5. Design and implement advanced IoT projects using Raspberry Pi and relevant sensors/actuators

COURSE OUTCOMES: Students will be able to:

SNO	OUTCOME
CO1	Explain the fundamental concepts of IoT and its various applications, as well as the functioning of Raspberry Pi hardware and software.
CO2	Demonstrate the ability to interface sensors and actuators with Raspberry Pi for IoT projects.
CO3	Comprehensive understanding of cloud technologies and their practical applications in real-world scenarios.
CO4	Design, develop, and deploy a cloud-based application using a selected cloud platform.
CO5	Develop innovative IoT projects that apply IoT concepts to real-world applications in various fields and troubleshoot IoT applications

UNIT-I: **Introduction to IoT and Raspberry Pi:** Introduction to IoT – Characteristics, architectures, protocols and applications of IoT (Basic information), Logical Design, Introduction to Raspberry Pi hardware and its components, Description of Raspberry Pi board, Setting up and configuring Raspberry Pi, Introduction to Raspbian OS, and R-Pi packages. **Project:** Blinking an LED, Buzzer and PWM implementation using Raspberry Pi GPIO pins and Python.
UNIT-II: **Interfacing Sensors and Actuators with Raspberry Pi:** Types of sensors, actuators, and their applications in IoT, Interfacing sensors and actuators with Raspberry Pi using GPIO pins, Writing Python programs to read sensor data, Hands-on experience in developing projects using sensors and actuators. **Project:** Reading temperature using a temperature sensor, PIR, IR and ultrasonic sensors and displaying the values on the Raspberry Pi LCD screen.
UNIT-III: **Cloud Technologies**: Microsoft Azure, Google Firebase, Amazon Web Services, ThingSpeak. (Basic Information and data storage procedures). **Project**: Controlling a LED using a mobile app through Wi-Fi using MQTT protocol.
UNIT-IV: **Data Analytics and Visualization:** Need for data analytics, and different tools for data analysis, Blynk, NodeRED. **Project:** Collecting temperature data using a temperature sensor and sending it to a cloud based IoT platform like ThingSpeak or Adafruit IO.
UNIT-V: **IoT Applications:** IoT applications in different fields such as healthcare, agriculture, and Smart Applications, Smart Cities and Smart Homes. Case Study: Agriculture, Healthcare, Activity Monitoring. Study of existing IoT platforms /middleware, IoT- A, Hydra etc. **Project:** Designing and implementing a home automation system using Raspberry Pi, sensors, and actuators to control lights and fans through a mobile app.

Text Books

1."Internet of Things with Raspberry Pi" by Marco Schwartz and Olivier Schwalm

2. “Internet of Things – A Hands-on Approach” by ArshdeepBahga, Vijay Madisetti, Universities Press, 2015.

3. "Raspberry Pi IoT Projects: Prototyping Experiments for Makers" by John C. Shovic

4. "IoT: Building Arduino-Based Projects" by Peter Waher

5. "Building Smart Drones with ESP8266 and Arduino" by Syed Omar Faruk Towaha

6. "Practical Internet of Things with JavaScript" by Arvind Ravulavaru

Reference Books

1. "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions" by Simon Monk

2. "Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux" by Derek Molloy

3. "Getting Started with Raspberry Pi" by Matt Richardson and Shawn Wallace

4. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes and Gonzalo Salgueiro

5. "Building Internet of Things with the Raspberry Pi" by Marco Schwartz

6. "Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects" by Maneesh Rao

E-Resources & other digital material:

1.Raspberry Pi Foundation: https://www.raspberrypi.org/

2. Adafruit Learning System: https://learn.adafruit.com/

3. Hackster.io: https://www.hackster.io/

4. Instructables: https://www.instructables.com/

5. Coursera: https://www.coursera.org/

6. edX: https://www.edx.org/

7. GitHub: https://github.com/

8. Raspberry Pi YouTube channel: https://www.youtube.com/user/RaspberryPiBeginners

9. The IoT Learning Initiative YouTube channel: https://www.youtube.com/channel/UC6UvP8O8_mNXwtUcbOKJLxw

IV-Year-I Semester
20PR4102

INDUSTRIAL/RESEARCH INTERNSHIP

L	T	P	C
0	0	6	3

IV-Year-II Semester
20PR4203

MAJOR PROJECT

L	T	P	C
0	0	0	12