ACADEMIC REGULATIONS AND COURSE STRUCTURE

(R19 Regulations)

ELECTRONICS AND COMMUNICATION ENGINEERING

FOR

B.Tech., FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2019-20)

VVIT

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

NAMBUR, PEDA KAKANI MANDAL, GUNTUR-522508

An Autonomous Institution, Approved by AICTE,

All Courses Accredited by NBA & NAAC with 'A' Grade, Permanently Affiliated to JNTUK University

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

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

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

VISION

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

MISSION

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

OBJECTIVES

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

Department Vision

To produce globally competitive and socially responsible engineering graduates and to bring out quality research and education, generating knowledge in the frontier areas of Electronics and Communication Engineering.

Department Mission

1. To achieve self-sufficiency on all fronts to ensure qualitative Teaching-Learning practices.
2. To provide quality education, student-centered Teaching-Learning processes and state of art infrastructure for professional aspirants hailing from both rural and urban areas.
3. To impart technical education that encourages independent thinking, developing strong domain knowledge, contemporary skills and attitude towards holistic growth of young minds.

4. Responsiveness to both local and global industry needs and creating opportunities through incubation and implementation of innovative programs.
5. To serve the community as disciplined responsible citizens in a rapidly changing and expanding global community.
6. Evolving this organization into a centre of academic and research excellence.

1. Admission Criteria

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

The sanctioned seats in each programme in the college are classified into CATEGORY-A, and CATEGORY-B at 1st year level and only CATEGORY-A at Lateral Entry 2nd year level.

The percentages of Category–A, Category-B and Lateral Entry Seats are decided from time to time by the Government of Andhra Pradesh.

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

2. Award of B. Tech. Degree

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

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

3. Courses of Study

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

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

4. Distribution and Weightage of Marks

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

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

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

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

iv) The Semester end examination shall be conducted for 3 hours duration. The question paper shall be given in the following pattern:

The question paper contains one question from each unit with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus. The questions shall be framed in line with the Course Outcomes defined and cognitive levels.

v) For practical subjects there shall be continuous internal evaluation during the semester for 25 marks and 50 Marks for Semester end examination. The internal 25 marks shall be awarded as follows: day to day work - 05 marks, Record-05 marks and the remaining 15 marks are to be awarded by conducting an internal laboratory test of 3 hours duration.

The semester end examination for laboratory courses shall be conducted for three hour duration at the end of semester for 50 marks as follows: Procedure - 10 marks, Experiment/Program execution – 15 Marks, Results-10 Marks and Viva-voice -15 Marks. For laboratory course in English 30 marks for written exam which includes listening comprehension and 20 marks for viva which includes JAM and Group Discussion.

vi) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 40 marks for internal evaluation (20 marks for day –to– day work, and 20 marks for internal tests) and 60 marks

for end examination. There shall be two internal tests in a Semester and the Marks for 20 can be calculated with 70% weightage for better of the two performances and 30% weightage for other and these are to be added to the marks obtained in day-to-day work.

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

The distribution of semester end examination marks for Engineering Project on Community services/Mini Project is as follows: Report -10 Marks and Presentation and Viva Voce – 20 Marks.

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

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

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

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

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

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

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

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

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

5. Attendance Requirements

- Students shall put in a minimum average attendance of 75% in the semester.
- Condonation of shortage in attendance may be recommended by the respective Head of the

Department on genuine medical grounds, provided the student puts in at least 65% attendance and the Principal is satisfied with the genuineness of the reasons and the conduct of the student.

- Students, having more than 65% and less than 75% of attendance, shall have to pay requisite fee towards condonation.
- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester. They may rejoin in that semester in which the student is detained by getting approval from the principal.
- If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible to readmit into the same class.

6. Minimum Academic Requirements

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

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

7. Course Pattern

- The entire course of study is for four academic years, all the years are on semester pattern and the medium of instruction is English.
- A student who eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.

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

8. CGPA

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

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

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

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

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

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

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

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

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

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

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

- The approximate equivalence of marks to a given CGPA is calculated by using the formula:

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

9. Award of Class

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

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

* Awarded only if all the credit courses prescribed are cleared within four years for regular candidates and three years for lateral entry candidates
* The students who are approved for break in study for entrepreneurships/start-ups will also be considered for award of first class with distinction
* For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the program shall be considered.

10. Minimum Days of Instructions

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

11. Transfer of Branch

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

12. Withholding of results

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

13. Transitory Regulations

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

14. Amendments to Regulations

Revisions of Regulations, Curriculum and Syllabi

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

15. Transferred Students

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

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ACADEMIC REGULATIONS (R19) FOR B. Tech.

(LATERAL ENTRY SCHEME)

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

1. Award of B. Tech. Degree

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

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

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

3. Promotion Rule

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

4. Award of Class

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

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

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

MALPRACTICE RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

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

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

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

	valuation or during special scrutiny.	has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Controller o Examinations for further action to award suitable punishment.	

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

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

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

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

LET US MAKE VVIT A RAGGING FREE CAMPUS

Ragging

ABSOLUTELY NO TO RAGGING

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

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

LET US MAKE VVIT A RAGGING FREE CAMPUS

R19 REGULATIONS - COURSE STRUCTURE

Structure of Credit Breakup of Program

S. No	Classification	Code	Credits
1	Humanities and Social Science (including electives)	HS	**12**
2	Basic Science courses	BS	**24**
3	Engineering Science courses	ES	**24**
4	Engineering Core courses	PC	**55**
5	Open Elective courses	OE	**12**
6	Professional Elective courses	PE	**18**
7	Internship, Seminar, Project Work	PR	**15**
8	Mandatory courses	MC	**0**
		Total	**160**

I INDUCTION PROGRAM

When new students enter an institution, they come with diverse thoughts, backgrounds andpreparations. It is important to help them adjust to the new environment and inculcate in them theethos 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 everyday 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 upto 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 thestudents 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 Colleg 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 wouldbe 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 arenot held daily for everyone:

Session	Activity	Remarks
IV	Familiarization with Department/Branch & Innovations	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)

III. SEMESTER-WISE STRUCTURE OF CURRICULUM

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

I Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	**BS01**	Mathematics – I	2	1	0	3
2	**BS02**	Applied Physics	3	0	0	3
3	**HSM01**	Communicative English	3	0	0	3
4	**ES01**	Programming for Problem Solving using C	3	0	0	3
5	**ES02**	Engineering Graphics and Design	0	0	3	1.5
6	**BS02L**	Applied Physics Lab	0	0	3	1.5
7	**HSM01L**	Communicative English Lab-I	0	0	3	1.5
8	**ES01L**	Programming for Problem Solving using C Lab	0	0	3	1.5
9	**MC01**	**Constitution of India**	3	0	0	0
Total Credits						**18**

I Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	**BS03**	Mathematics – II	2	1	0	3
2	**BS04**	Mathematics –III	2	1	0	3
3	**BS05**	Applied Chemistry	3	0	0	3
4	**ES03**	Basic Electrical Engineering	3	0	0	3
5	**ES04**	Data Structures	2	0	0	2
6	**ES05L**	Engineering Workshop	0	0	3	1.5
7	**BS05L**	Applied Chemistry Lab	0	0	3	1.5
8	**ES03L**	Basic Electrical Engineering Lab	0	0	3	1.5
9	**ES04L**	Data Structures Lab	0	0	3	1.5
10	**HSM02L**	Communicative English Lab-II	0	0	3	1.5
11	**MC02**	**Environmental Science**	0	0	0	0
Total Credits						**21.5**

II Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	**BS06**	Complex Variables and Statistical Methods	2	1	0	3
2	**EC01**	Electronic Devices and Circuits	3	0	0	3
3	**EC02**	Signals and Systems	2	1	0	3
4	**EC03**	Digital Circuits and Logic Design	3	0	0	3
5	**ES06**	Networks and Transmission Lines	3	0	0	3
6	**ES07**	Python Programming	2	0	0	2
7	**MC03**	**Essence of Indian Traditional Knowledge**	2	0	0	0
8	**EC01L**	Electronic Devices and Circuits Lab	0	0	3	1.5
9	**EC02L**	Signals and Systems Lab	0	0	3	1.5
10	**ES07L**	Python Programming Lab	0	0	3	1.5
Total Credits						**21.5**

II Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	**BS07**	Random Variables and Stochastic Processes	3	0	0	3
2	**EC04**	Analog Circuits	3	0	0	3
3	**EC05**	Electromagnetic Fields and Waves	3	0	0	3
4	**EC06**	Digital System Design with VHDL	2	0	0	2
5	**EC07**	Analog and Digital Communications	3	0	0	3
6	**ES08**	Control Systems	2	0	0	2
7	**EC05L**	Analog Circuits Lab	0	0	3	1.5
8	**EC06L**	Analog and Digital Communications Lab	0	0	3	1.5
9	**EC07L**	Digital System Design with VHDL Lab	**0**	**0**	3	1.5
Total Credits						**20.5**

III Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	**EC08**	Linear IC Applications	3	0	0	3
2	**EC09**	Micro Processors and Micro Controllers	3	0	0	3
3	**EC10**	Antennas and Wave Propagation	3	0	0	3
4	**EC11**	VLSI Design	3	0	0	3
5	**OE01**	Open Elective – 1	3	0	0	3
6	**EC12**	Computer Networks	3	0	0	3
7	**EC08L**	Linear IC Applications Lab	0	0	3	1.5
8	**EC09L**	Micro Processors and Micro Controllers Lab	0	0	3	1.5
9	**EC11L**	VLSI Design Lab	0	0	3	1.5
Total Credits						**22.5**

III Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	**EC13**	Digital Signal Processing	3	0	0	3
2	**HSM03**	Managerial Economics and Financial Analysis	3	0	0	3
3	**EC14**	Microwave Engineering	3	0	0	3
4	**PE01**	Professional Elective - 1	3	0	0	3
5	**PE02**	Professional Elective – 2	3	0	0	3
6	**EC13L**	Digital Signal Processing Lab	0	0	3	1.5
7	**MC04**	**Indian Patents and Rights**	2	0	0	0
8		**Mini Project**	0	0	6	3
Total Credits						**19.5**

IV Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	**HSM04**	Management Science	2	0	0	2
2	**PE03**	Professional Elective – 3	3	0	0	3
3	**PE04**	Professional Elective -4	3	0	0	3
4	**PE05**	Professional Elective -5	3	0	0	3
5	**OE02**	Open Elective -2	3	0	0	3
6	**EC14L**	Microwave Engineering and Optical Communication Lab	0	0	3	1.5
7		**Project Stage – 1**			8	4
Total Credits						**19.5**

IV Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	**PE06**	Professional Elective – 6	3	0	0	3
2	**OE03**	Open Elective – 3	3	0	0	3
3	**OE04**	Open Elective – 4	3	0	0	3
4		**Project Stage – 2**	0	0	16	8
Total Credits						**17**

PROFESSIONAL ELECTIVES

Professional Elective- I	Professional Elective- II	Professional Elective- III	Professional Elective- IV	Professional Elective- V	Professional Elective- VI
Cellular & Mobile Communication	Information Theory & Coding	Radar Engineering	Optical Communications	Cognitive Radio	Satellite Communications
ASIC Design	Low Power VLSI	Analog IC Design	CPLD & FPGA	MEMS	Scripting Languages
Machine Learning	Embedded & Real Time Operating Systems	Embedded System Design and Robotics	Internet of Things	Pattern Recognition	Deep Learning
Digital TV Engineering	Bio-Medical Electronics	Speech Signal Processing	DSP Processors & Architectures	Digital Image Processing	Multimedia Processing

OPEN ELECTIVES

Open Elective- I	Open Elective- II	Open Elective- III	Open Elective- IV
OOPS Through Java	Neural Networks	Operating Systems	Database Management Systems
MATLAB for Engineering Applications	Energy Auditing	Advanced Control Systems	Programming Logic Controllers
Total Quality Management	Supply Chain Management	Product Design & Development	Entrepreneurial Skill Development
Disaster Management	Green Buildings	Environmental Pollution and Control	Remote Sensing & GIS Applications

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I Year – I SEMESTER

L	T	P	C
3	0	0	3

MATHEMATICS – I (Calculus)
(Common to ALL branches)

Course Objectives:

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

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

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

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

Unit-2: Linear differential equations of higher order:

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

Applications: LCR circuit – Simple harmonic motion

Unit-3: Mean value theorems:

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

Unit-4: Partial differentiation:

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

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

Unit-5: Multiple integrals:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

- Solve the differential equations related to various engineering fields.
- Utilize mean value theorems to real life problems.
- Familiarize with functions of several variables which is useful in optimization.
- Apply double integration techniques in evaluating areas bounded by region.
- Learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3 – dimensional coordinate systems.

I Year – I SEMESTER

L	T	P	C
3	0	0	3

APPLIED PHYSICS

Course Objectives:

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

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

Unit-I: Wave Optics:

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

Unit– II: LASERs and Holography

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

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

Unit-III: Magnetism and Dielectrics

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

Dielectrics:

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

Unit– IV: Quantum Mechanics

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

Unit– V: Semiconductor Physics

Origin of energy bands(qualitative)-Classification of solids based on energy bands–Intrinsic semiconductors-density of charge carriers–Electrical conductivity-Fermi level–extrinsicsemiconductors-P-type&N-type-Densityofchargecarriers- 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 AjoyGhatak, 6th Edition McGraw Hill Education, 2017.

3. "Solid State Physics" by A.J.Dekker, Mc Millan Publishers (2011).

Course Outcomes:

The students will be able to

1. **Understand** the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments.

2. **Learn** the basic concepts of LASER light Sources and Apply them to holography
3. **Study** the magnetic and dielectric materials to enhance the utility aspects of materials.
4. **Learn** the fundamental concepts of Quantum behaviour of matter.
5. **Identify** the type of semiconductors using Hall Effect.

I Year – I SEMESTER

L	T	P	C
3	0	0	3

COMMUNICATIVE ENGLISH
(Common to All Branches)

Course Objectives

1. Adopt activity based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions.

Facilitate effective listening

Course Objectives

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

Course Outcomes

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

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

Syllabus Blueprint

Contents	Learning Outcomes	Bloom's Level	No of Hrs
Unit-1 **Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.	1. Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English 2. ask &answer general questions on familiar topics 3. employ suitable strategies for skimming &scanning to get the general idea of a text and	L3 L2 L3	10

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing:** Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.	specific information 4. recognize paragraph structure with beginnings/endings 5. form sentences using proper grammatical structures and correct word forms	L3 L3	
Unit-2 **Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.	1. comprehend short talks on general topics 2. speak clearly on a specific topic using suitable discourse markers in informal discussions 3. understand the use of cohesive devices for better reading comprehension 4. write well-structured paragraphs on specific topics 5. make necessary grammatical corrections in short texts	L2 L3 L2 L3 L3	10
Unit-3 **Listening:** Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-	1. summarize the content with clarity &precision from short talks 2. report what is discussed in informal discussions 3. infer meanings of unfamiliar words using contextual clues 4. write summaries based on global comprehension of reading/ listening texts 5. use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing	L3 L3 L3 L3 L3	10

verb agreement; direct and indirect speech, reporting verbs for academic purposes.			
Unit-4 **Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms	1. infer &predict about content of spoken discourse 2. engage in formal/informal conversations understanding verbal &non-verbal features of communication 3. interpret graphic elements used in academic texts 4. produce a coherent paragraph interpreting a figure / graph / chart / table 5. use language appropriate for description and interpretation of graphical elements	L4 L3 L2 L4 L4	10
Unit-5 **Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences **Grammar and Vocabulary:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)	1. take notes while listening to a talk/lecture to answer questions 2. make formal oral presentations using effective strategies 3. produce a well-organized essay with adequate details 4. edit short texts by correcting common errors	L3 L3 L3 L4	10

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I Year – I SEMESTER

L	T	P	C
3	0	0	3

PROGRAMMING FOR PROBLEM SOLVING USING C

(Common to All Branches)

Course Objectives:

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

UNIT-I: Introduction to C

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

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

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

UNIT-II: Control Flow & Modules

Selection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples. **Repetition**: Basic Loop Structures, Pre-test and Post-test Loops, Counter-Controlled and Condition-Controlled Loops, for, while and do while.

Branching: break & continue.

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

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

UNIT-III Arrays & Strings

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

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

Unit – IV Pointers & Structures

Pointers: Concept of a Pointer, Initialization of Pointer variables, Pointers as function arguments, Passing by address, Dangling memory, Pointer Arithmetic, Character pointers,

Pointers to Pointers, Array of pointers & Pointer to array, Dynamic memory management functions, Command line Arguments.

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

UNIT-V: Files

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

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

Text Books:

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

Reference Books:

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

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

CO 1: Understand algorithms and basic terminology of C

CO 2: Solve problems using control structures and modular approach

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

CO 4: Determine the use of pointers and structures

CO 5: Implement various operations on data files.

I Year – I SEMESTER

L	T	P	C
0	0	3	1.5

ENGINEERING GRAPHICS

Course Objectives:

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

UNIT-I: INTRODUCTION TO AUTOCAD:

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

UNIT-II: THEORY OF PROJECTION:

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

UNIT III: PROJECTIONS OF REGULAR SOLIDS:

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

UNIT IV: DEVELOPMENT OF SURFACES & SECTIONAL ORTHOGRAPHIC VIEWS

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

UNIT V: ISOMETRIC PROJECTIONS

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

TEXT BOOKS:

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

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

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

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

REFERENCE BOOKS:

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

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

3. Engineering Graphics by PI Varghese, McGrawHill Publishers

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

Websites

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

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

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

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

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

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

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

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

I Year – I SEMESTER

L	T	P	C
0	0	3	1.5

COMMUNICATIVE ENGLISH LAB- I
(Common to All branches)

Course Objectives

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

The specific objectives of the course are to

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

Course Outcomes

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

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

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

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

Detailed Syllabus

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

Introduction to Sound System of English

Articulation - Airstream mechanism, Manners of Articulation, Places of Articulation, English phonetic symbols. Accent - Syllabification, word stress and accent, stress rules and stress shift, exceptions to rules. Intonation - Stress and accent in connected speech. Types and functions of Intonation in English. Pair work, Role play, conversational practice and Individual speaking activities based on following essays from **University of Success.**

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

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

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

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

Text Books

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

Reference Books

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

AICTE Recommended Books

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

Sample Web Resources

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

I Year – I SEMESTER

L	T	P	C
0	0	3	1.5

PROBLEM SOLVING USING C LAB

(Common to All Branches)

Course Objectives:

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

Exercise - 1 Control Flow - I

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

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

Exercise – 2 Control Flow - II

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

i) Prime Number

ii) Armstrong Number

Exercise – 3 Control Flow - III

a) Write a C program to print Floyd Triangle

b) Write a C Program to print Pascal Triangle

c) Write a C program to display a Pyramid

Exercise – 4 Arrays - Demonstration of arrays

a) Search-Linear.

b) Sorting-Bubble

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

Exercise – 5 Strings

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

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

Exercise – 6 Functions

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

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

Exercise – 7 Functions - Continued

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

Exercise - 8 Arrays, Strings and Pointers

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

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

Exercise – 9 Dynamic Memory Allocations

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

Exercises - 10 Structures

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

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

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

Exercise -11 Files

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

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

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

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

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

I Year – I SEMESTER

L	T	P	C
3	0	0	0

INDIAN CONSTITUTION

Course Objectives:

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

UNIT-I

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

LEARNING OUTCOMES:

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

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, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT-III

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

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariate

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

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zilla panchayat block level organisation

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

LEARNING OUTCOMES: - After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

REFERENCES:

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

E-RESOURCES:

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

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

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.

- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

Course Outcomes:

CO-1	Know the sources, features and principles of Indian Constitution.
CO-2	Learn about Union Government, State government and its administration.
CO-3	Get acquainted with Local administration and Pachayati Raj.
CO-4	Be aware of basic concepts and developments of Human Rights.
CO-5	Gain knowledge on roles and functioning of Election Commission

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I Year – II SEMESTER

L	T	P	C
2	1	0	3

MATHEMATICS-II
(Common to All)

Course Objectives:

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

UNIT-1: Iterative methods: (10 hrs)

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

UNIT-2: Interpolation: (12 hrs)

Introduction–Errors in polynomial interpolation–Finite differences–Forward differences–Backward differences–Central differences –Relations between operators–Newton's forward and backward formulae for interpolation–Gauss's forward and backward formulae for

Interpolation – Interpolation with unequal intervals–Lagrange's interpolation formula–Newton's divide difference formula.

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

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

UNIT–4: Laplace Transforms: (14 hrs)

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

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

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

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

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

Text Books:

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

Reference Books:

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

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

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

I Year – II SEMESTER

L	T	P	C
2	1	0	3

MATHEMATICS – III
(Common to ALL branches)

Course Objectives:

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

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

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

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

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

Application: Free vibration of two mass systems.

UNIT – III: Vector Differentiation: (10 hrs)

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

UNIT– IV: Vector Integration: (12 hrs)

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

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

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

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

Text Books:

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

Reference Books:

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

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

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan (L3)
- to interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L5)
- identify the solution methods for partial differential equation that model physical processes (L3)

I Year – II SEMESTER

L	T	P	C
3	0	0	3

APPLIED CHEMISTRY

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

Learning Objectives:

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

UNIT-I: POLYMER TECHNOLOGY 14 HRS

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

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

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

Composite Materials: Fiber reinforced plastics-CFRP and GFRP

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

Bio degradable polymers: Biopolymers and biomedical polymers.

UNIT-II: ELECTROCHEMICAL CELLS AND CORROSION 12 HRS

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

Corrosion: Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, water-line corrosion- passivity of metals-

galvanic series-factors influencing rate of corrosion-corrosion control: (proper designing, cathodic protection)-protective coatings: cathodic and anodic coatings, electroplating, electroless plating (nickel), paints (constituents and its functions).

UNIT-III: MATERIAL CHEMISTRY 12 HRS

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

Insulators, Ferro, Ferri Magnetic Materials, Hall Efect

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

Liquid crystals: Introduction-types-applications.

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

UNIT-IV: ADVANCED CONCEPTS AND GREEEN CHEMISTRY 10 HRS

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

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

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

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

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

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

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

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

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

REFERENCE BOOKS:

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

TEXT BOOKS:

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

Course Outcomes:

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

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

I Year – II SEMESTER

L	T	P	C
3	0	0	3

BASIC ELECTRICAL ENGINEERING

Course objectives: The student should be able to

- To introduce the concepts of electrical circuits and verify theorems in DC circuits.
- To analyse different concepts of single phase AC circuits.
- To realise the working and applications of DC machines.
- To analyse the operation of single phase Transformers.
- To realise the working and applications of AC machines.

Unit – 1: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's laws, star and delta transformation, Mesh and Nodal analysis, Superposition, Thevenin's, Norton's and Maximum power transfer theorems for simple circuits with dc excitation.

Unit -2: AC Circuits

RMS and Average values of sinusoidal waveform, phasor representation, active power, reactive power, apparent power and power factor. Analysis of simple RLC (series and parallel) circuits with AC excitation. Concept of Resonance, bandwidth and quality factor.

Unit -3: DC Machines

DC Generator: Working Principle and Construction Details, EMF equation, Types of DC Generators, OCC of DC generator, Numerical problems (Elementary treatment only).

DC Motor: Working Principle, Torque equation, three point starter, brake test, speed control methods, applications, Numerical problems (Elementary treatment only).

Unit -4: Transformers

Working principle and Construction Details, Operation under No-load and different loads with phasor diagrams, equivalent circuit, losses, efficiency and voltage regulation. OC & SC Tests, Numerical problems (Elementary treatment only).

Unit -5: AC Machines

Three phase induction motors: Working principle and Construction Details, concept of slip, torque-slip characteristics, Brake test, Losses, efficiency and applications, Numerical problems (Elementary treatment only).

Alternators: Working principle and Construction Details, EMF equation, Numerical problems (Elementary treatment only).

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

References:

1. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

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

CO1: Able to understand the concepts of electrical circuits and verify theorems in DC circuits.

CO2: Able to analyse different concepts of single phase AC circuits.
CO3: Able to explain the working and applications of DC machines.
CO4: Able to understand the operation of single phase Transformers.
CO5: Able to understand the working and applications of AC machines.

PO – Program Outcomes (PO 1: Engineering knowledge, PO 2: Problem analysis, PO 3: Design/Development of Solutions, PO 4: Conduct investigations of complex problems, PO 5: Modern tool usage, PO 6: The engineer and society, PO 7: Environment and sustainability, PO 8: Ethics, PO 9: Individual and team work, PO 10: Communication, PO 11: Project management and finance, PO 12: Life-long learning).

I Year – II SEMESTER

L	T	P	C
2	0	0	2

DATA STRUCTURES

Course Objectives:

1) To solve problems using data structures such as linear lists, stacks, queues.

2) To explore advanced data structures such as balanced search trees.

3) To be familiar with Graphs and their applications.

4) To analyze various sorting techniques.

UNIT-I: Arrays (12 hrs)

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

UNIT-II: Stack & Queue (10 hrs)

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

Unit – III: Linked Lists (10 hrs)

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

UNIT-IV: TREES (8 hrs)

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

UNIT-V: GRAPHS (12 hrs)

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

TEXT BOOKS:

1. Data structures, Algorithms and Applications in C, S.Sahni, University Press (India) Pvt. Ltd, 2nd edition, Universities Press, Pvt. Ltd.

2. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd, Second Edition.

3. Data Structures, Schaum'sOutline,SeymourLipschutz, Kindle Edition.

REFERENCE BOOKS:

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

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

CO1: Implementvarious operations on linear lists.

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

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

CO4: Incorporate data structures into the applications such as binary trees, binary search trees.

CO5: Identify appropriate data structure algorithms for graphs.

I Year – II SEMESTER

L	T	P	C
0	0	3	1.5

ENGINEERING WORKSHOP

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

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

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

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

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

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

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

Electrical Wiring:
Familiarities with different types of basic electrical circuits and make the following connections
a) Parallel and series b) Two way switch c) Godown lighting d) Tube light e) Three phase motor f) Soldering of wires

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

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

I Year – II SEMESTER

L	T	P	C
0	0	3	1.5

APPLIED CHEMISTRY LAB
(Common to All Branches)

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

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

Note: Choice of any 10 experiments from the above.

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

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

Reference Books:

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

I Year – II SEMESTER

L	T	P	C
0	0	3	1.5

BASIC ELECTRICAL ENGINEERING LAB

Course Objectives:

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

Course Outcomes:

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

PO – Program Outcomes (PO 1: Engineering knowledge, PO 2: Problem analysis, PO 3: Design/Development of Solutions, PO 4: Conduct investigations of complex problems, PO 5: Modern tool usage, PO 6: The engineer and society, PO 7: Environment and sustainability, PO 8: Ethics, PO 9: Individual and team work, PO 10: Communication, PO 11: Project management and finance, PO 12: Life-long learning).

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. Resonance in series and parallel RLC circuits.
6. Calculations and Verification of Impedance and Current of RL, RC and RLC series Circuits.
7. Draw the OCC of DC Shunt Generator.
8. Draw the performance characteristics of DC Shunt Motor.
9. Speed control of DC Shunt Motor-Armature and field control methods.
10. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer.
11. OC & SC tests on Single phase Transformer.
12. Load Test on Single Phase Transformer
13. Performance Characteristics of a Three-phase Induction Motor

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
3.

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.

I Year – II SEMESTER

L	T	P	C
0	0	3	1.5

DATA STRUCTURES LAB
(Common to ECE& EEE)

Course Objectives:

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

List of Experiments:

Excercise-1: Implementation of Data Searching (Linear & Binary Search).

Excercise-2: Write C code for implementing sorting techniques: Selection & Insertion.

Excercise-3: Develop C code to demonstrate Merge Sort technique in C.

Excercise-4: Implementation of Quick Sort technique in C.

Excercise-5: Implement Stack operations using arrays –

i) push ii) pop iii) is Stack empty iv) is Stack full, v) peep vi) list.

Excercise-6: Implement Queue operations using arrays –

i) enqueue, ii) dequeue, iii) list, iv) is Queue empty, v) is Queue full

Excercise-7: Create a Circular Queue and its operations using arrays –

i) enqueue, ii) dequeue, iii) list, iv) is Queue empty, v) is Queue full

Excercise-8: Implement singly linked list and its operations:

i) insert, ii) delete, iii) search, iv) count.

Excercise-9: Create a Circular linked list and display the content.

Excercise-10: Implement doubly linked list and its operations:

i) Create ii) List iii) search.

Excercise-11: Develop C code for converting an Infix expression to postfix notation.

Excercise-12: Implementation of Binary Search trees operations: create, Inorder, Preorder, Postorder.

Excercise-13: Implementation of Heaps through C code.

Excercise-14: Develop C code to demonstrate Breadth First Search Techniques.

Excercise-15: Develop C code to demonstrate Depth First Search Techniques.

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

CO 1: Implement the data structures with the basic level knowledge.

CO 2: Design and analyze the time efficiency of the data structure.

CO 3: Design and analyzethe Space efficiency of the data structure in the memory.

CO 4: Identifies the appropriate data structure for given problem.

CO 5: Compare and Contrast various data structures and design techniques in the area of Performance.

I Year – II SEMESTER

L	T	P	C
0	0	3	1.5

COMMUNICATIVE ENGLISHLAB-II
(Common to All Branches)

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

The specific objectives of the course are to

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

Course Outcomes

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

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

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

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

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

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

Detailed Syllabus

CALL based activity. English course books selected for classroom teaching will be used for practice in thecomputer-based language labs. Watching and listening to Video clips.
Listening Activity: Selected speeches of eminent personalities, audio texts, dialogues and discussions
Speaking: JAM, Oral Presentations, Group Discussions
Writing: Different types of reports
Project: Power point presentation of 5 min on a specific topic
Pair work, Role play, conversational practice and Individual speaking activities based on following essays from **University of Success**.
1. "How to Get Yourself Organized" by Michael LeBeouf
2. "How to Turn Your Desires into Gold" by Napoleon Hill
3."How to Look Like a Winner How to Increase Your Value" by OgMandino
4."How to Swap a Losing Strategy" by Auren Uris and Jack Tarrant
5."How to Bounce Back from Failure" by OgMandino
6."How to Prevent Your Success from Turning into Ashes" by Allan Fromme
7."How to Have a Happy Life" by Louis Binstock

8. “How to Keep the Flame of Success Shining Brightly” by Howard Whitman

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

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

Text Books

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

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

Reference Books

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

AICTE Recommended Books

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

Sample Web Resources

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

II Year-I SEMESTER **L T P C**
2 1 0 3

COMPLEX VARIABLES AND STATISTICAL METHODS

Pre-Requisites :

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

Course objectives: The student should be able to

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

Unit No	Contents	Mapped CO
I	**Functions of a complex variable and complex integration** **Functions of a complex variable (05 hrs)** Introduction– Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne-Thompson method. **complex integration (05 hrs)** Complex integration– Line integral – Cauchy's integral theorem – Cauchy's integral formula. (All without proofs).	CO1
II	**Series expansions and Residue Theorem** **Series expansions (05 hrs)** Radius of convergence –Expansion in Taylor's series, Maclaurin's series - Laurent's series. **Residue Theorem (05hrs)** Types of singularities–Isolated – pole of order m – Essential – Residues – Residue theorem (without proof)	CO2
III	**Probability, Distributions and Sampling Theory** **Probability, Distributions (07hrs)** Probability-Baye's theorem-Random variables-Discrete and Continuous random variables-Distribution function-Mathematical Expectation and Variance-Binomial, Poisson and Normal distributions. **Sampling Theory (07hrs)**	CO3

	Population and samples-Sampling distribution of Means -Point and Interval estimations-Maximum error of estimate**.**	
IV	**Test of Hypothesis** **(14hrs)** Introduction–Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of significance-One tail and two-tail tests-Tests concerning one mean and two means (Large and Small samples)-Tests on proportions.	**CO4**
V	**Curve fitting and Correlation** **(12hrs)** Method of least squares-Straight line-Parabola-Exponential-Power curves-Correlation-Correlation coefficient-Rank correlation-Regression coefficient and properties-Regression lines.	**CO5**

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

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

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

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

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

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

Text books:

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

Reference books:

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

e- Resources & other digital material:

1. https://www.youtube.com/watch?v=Mwpz1zjPlzI&list=PLbMVogVj5nJS_i8vfVWJG16mPcoEKMuWT (For Complex Variables)
2. https://www.youtube.com/playlist?list=PLiUVvsKxTUr66oLF6Pzirc1EgSstMbRZR(For Complex Variables from 1-13)

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

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II Year-I SEMESTER

L	T	P	C
3	0	2	3

ELECTRONIC DEVICES AND CIRCUITS

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 No	Contents	Mapped CO
I	**Junction Diode Characteristics (11 Hrs)** 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 Diodes Theory (04 Hrs)** Varactor Diode, Breakdown mechanisms in diodes, V-I Characteristics of Zener diode, and LED, photo diode.	CO1
II	**Diode Applications (11 Hrs)** 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.	CO2
III	**Bi-polar Junction Transistors(BJT) (07 Hrs)** N-P-N and P-N-P transistors, Operation of BJT, Early effect, Current equations, Input and Output characteristics of CB and CE, BJT as an Amplifier **Junction Field Effect Transistors(JFET) (04 Hrs)** Junction Field Effect Transistor (JFET) structure, Drain and Transfer Characteristics, Significance of Pinch-Off Voltage, JFET as an amplifier and switch. **Metal-Oxide-Semiconductor Field Effect Transistors (MOSFET) (04 Hrs)** Structure of Depletion-MOSFET and Enhancement-MOSFETs, V-I Characteristics of MOSFET, Significance of threshold voltage. **Uni-Junction Transistor(UJT) (01 Hr)** Construction and working of UJT	CO3
IV	**Transistor Biasing (12 Hrs)** Need for Proper Biasing, Q-point stability, Fixed, Collector to Base bias and Voltage Divider biasing for BJT, Emitter Degeneration, Design of Self Biasing circuit, Thermal Stability considerations. Fixed, Voltage Divider biasing for JFET and MOSFETs.	CO4

V	**Small Signal Low frequency analysis of BJT and FET amplifiers (12 Hrs)** Transistor Hybrid model, r_π model. Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE, CB and CC configurations, Transistor amplifying action, Analysis of CE, CC, CB Amplifiers. Simplified h-parameter model, analysis of CE Amplifier with emitter resistance, the r_π model of CE. Small Signal Mo del, Analysis of JFET Amplifiers, Analysis of CS, CD JFET Amplifiers.	**CO5**

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 level)**

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

CO3: **Explain** the working principles of BJTs and FETs **(Understand level)**

CO4: **Learn** the art of biasing of BJTs and FETs **(Apply level)**

CO5: **Apply** the equivalent small signal low frequency models of BJTs and FETS in amplifier analysis **(Analyze level)**

Text books:

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

Reference books:

1. Robert L.Boylestead and Louis Nashelsky,”Electronic Devices and Circuit Theory”,Pearson Education Inc.Eleventh Edition 2013
2. Adel S. Sedra and Kenneth C. Smith, “ Microelectronic Circuits”, Oxford University Press, 2004 Edition.

e- Resources & other digital material:

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

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II Year-I SEMESTER **L T P C**
2 1 0 3

SIGNALS AND SYSTEMS

Pre-Requisites : Engineering Mathematics-1 and 3

Course objectives: The student should be able to

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 signal from 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 and systems.
5. Understand Z-transforms and their properties for analysis of signals and **systems.**

Unit No	Contents	Mapped CO
I	**Signals Analysis and Fourier Series Signal Analysis (09hr)** Definition Signal (Continuous time and Discrete time), Elementary signals such as Dirac delta, unit step, unit ramp, sinusoidal and exponential. Classification of signals, time operations on signals. Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions. **Fourier Series (06hr)** Representation of Fourier series, Dirichlet's conditions, Properties of Fourier Series, Trigonometric Fourier Series and Exponential/Complex Fourier Series, Complex Fourier spectrum.	CO1
II	**Fourier Transform and Sampling Theorem** **Fourier Transform (08hr)** 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 (05hrs**) 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.	CO2
III	**Signal transmission through Linear Time Invariant(LTI) Systems and Convolution and Correlation** **Signal transmission through Linear Time Invariant(LTI) Systems (07hrs**) System definition (continuous and discrete), properties of systems, impulse response, transfer function, LTI system response, Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system	CO3

	bandwidth, Causality and Poly-Wiener criterion for physical realizable systems. **Convolution and Correlation (09hrs)** 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	
IV	**Laplace Transforms (08hrs)** 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.	**CO4**
V	**Z-Transforms (08hrs)** Concept of Z- Transform and Inverse Z-Transform, Distinction between Laplace, Fourier and Z -transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Properties of ROC of Z-Transform, Properties of Z-transforms, Inverse Z-transform, Response of LTI system using Z-Transform, Introduction to DTFT, Relationship between ZT and DTFT, Conversion from Laplace transform to Z-transform and vice-versa, Introduction to DTFT, Relationship between ZT and DTFT.	**CO5**

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)**

Text books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications,2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H.Nawab, PHI, 2nd Edn.
3. Signals & Systems - Narayan Iyer and K Satya Prasad ,Cengage Pub.
4. Principles of Linear Systems and Signals by B.P.Lathi, Oxford publications, Second Edition.

Reference books:

1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Signals and Systems – K R Rajeswari
3. Fundamentals of Signals and Systems- Michel J. Robert, MGHInternational Edition, 2008.
4. Signals and Stochastic Processes- Y Mallikarjuna Reddy and GiriBabuKande, University Press, 1st edition.

e- Resources & other digital material:

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

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I Year-I SEMESTER

L	T	P	C
3	0	2	3

DIGITAL CIRCUITS AND LOGIC DESIGN

Pre-Requisites : Nil

Course objectives: The student should be able to

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

Unit No	Contents	Mapped CO
I	**Number Systems and Boolean Algebra** **14 Hours** **Number systems:** Introduction to different number system and their conversions, Complement of number system and subtraction using complement method, Floating-Point Representation, Weighted and Non-weighted codes and its Properties, Error detection and correction codes, **Boolean Algebra:** Boolean algebra and logic gates, Basic theorems and properties of Boolean Algebra, Boolean functions, canonical and standard forms, Universal Gates.	CO1
II	**Minimization Methods of Boolean functions** **11 Hours** Minimization of logic expressions by algebraic method, Sum of Products (SOP), Product of Sums (POS), K-Map Method, Don't Care Combinations, Multilevel NAND/NOR realizations, Prime and essential Prime Implicants, Tabular Method, Prime Implicants Chart, Simplification Rules.	CO2
III	**Combinational Circuits** **14 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.	CO3

IV	**Sequential Circuits** **12 Hours** Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another. Registers and Counters: Shift Registers Left, Right and Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.	**CO4**
V	**Sequential Machines** **8 Hours** Finite State Machines, Synthesis of Synchronous Sequential Circuits, Mealy and Moore models, Serial Binary Adder, Sequence Detector, Parity-bit Generator Synchronous Modulo N – Counters, Finite state machine capabilities and limitations.	**CO5**

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)**

Text books:

1. Digital Design by Mano, PHI
2. Modern Digital Electronics by RP Jain, TMH
3. Switching Theory and Logic Design by A. Anand Kumar, PHI.

Reference books:

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

e- Resources & other digital material:

1. https://nptel.ac.in/courses/117/106/117106086/

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II Year-I SEMESTER

L	T	P	C
3	0	0	3

NETWORKS AND TRANSMISSION LINES

Pre-Requisites: Basic Electrical Engineering

Course objectives: The student should be able to

1. To make the students capable of analyzing any given electrical network.
2. To solve the given ac circuit with various theorems and methods.
3. To understand the basic concepts on RLC circuits under steady and transient states using time domain and Laplace domain techniques.
4. To understand the two port network parameters and transform two port networks.
5. To analyze the properties of Transmission lines and to understand smith chart usage.

Unit No	Contents	Mapped CO
I	**DC and Sinusoidal Steady State Analysis of Electrical Circuits:** **DC Analysis (06hr)** Basic mesh and node analysis, solving problems with dependant sources. **Sinusoidal Steady State Analysis (09hr)** Review AC fundamentals, Mesh and Node analysis for AC circuits, Super Position, Thevenin's, Norton's and Maximum Power transfer theorem for AC circuits.	CO1
II	**Two Port networks and Magnetically Coupled circuits:** **Two Port Networks (10hr)** Two port parameters, short circuit admittance parameter, open circuit impedance parameters, Transmission parameters, Image parameters and Hybrid parameters. Ideal two port devices, ideal transformer. Tee and Pie circuit representation, Cascade and Parallel Connections. **Coupled Circuits (05hr)** Coupled circuits and dot convention, coefficient of coupling, Analysis of coupled circuits.	CO2
III	**Network Transients Transients (15hr)** Source free response in RL, RC, and RLC networks using Time Domain methods, Evaluating initial conditions procedure, DC response in RL, RC and RLC circuits. Laplace transforms method to analyse RL, RC and RLC circuits with step and sinusoidal excitations.	CO3
IV	**Transmission Lines- General Characteristics (10hr)** Transmission Lines, their types and applications, Distributed constants, Transmission line equation, expression for voltage, current and impedance at a point on the line. Secondary Constants, Concept of infinite line, Low-loss transmission lines, impedance on line and related problems.	CO4
V	**Transmission Lines- Wave Phenomenon (10hr)** Waves Phenomenon on Transmission lines, concept of reflection and standing waves, definition of reflection coefficient, VSWR and power relations, Transmission lines at high frequencies and applications, smith chart, Single stub Matching and related Problems.	CO5

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

CO1 Apply the mesh and node methods to analyze the behavior of electrical circuits (RLC circuits)under steady state conditions.
(Apply)

CO2 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)

CO3 Analyze the transient behavior of RLC circuits in detail using time domain and s-domain methods.
(Analyze)

CO4 Familiarize with the general characteristics of transmission lines by applying the basic circuit laws and concepts.
(Understand)

CO5 Articulate how the standing wave phenomenon is formed on transmission lines and be able solve the problems of transmission line using Schmidt chart**(Understand)**

Text books:

1. Hayt, Kemmerly and Durbin "Engineering Circuit Analysis", TMH
2. Charles K Alexander and Mathew N O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw-Hill.
3. Y.MallikarjunaReddy "Electromagnetic Waves and Transmission Lines", University Press.
4. Matthew N.O. Sadiku "Elements of Electromagnetics", Oxford Univ. Press.

Reference books:

1. John D. Ryder "Networks, Lines and Fields", PHI, 2nd edition.
2. Edminister "Electric Circuits – Schaum's Outline Series", McGraw-Hill
3. Umesh Sinha, Satya Prakashan "Transmission Lines and Networks", Tech. India publications, New Delhi.
4. Ravish R., Network Analysis and Synthesis, McGraw-Hill.

e- Resources & other digital material:

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

II Year-I SEMESTER **L T P C**
2 0 0 2

PYTHON PROGRAMMING

Pre-Requisites: Knowledge of any programming language

Course objectives: The student should be able to

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

Unit No	Contents	Mapped CO
I	**Introduction to Python (12hrs)** **Introduction**: History of Python, Need of Python Programming, Basics of Python Programming Using the REPL(Shell), Variables, Assignment, Keywords, Input-Output, Indentation. **Types, Operators**: Types– Integers, Strings, Booleans; Operators – Arithmetic, Comparison (Relational), Assignment, Logical, Bitwise, Membership and Identity Operators	CO1
II	**Control and Data Structures (13hrs)** **Control Structures**: if, if-elif-else, for, while, break, continue, pass. **Data Structures**: Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions	CO2
III	**Functions and File handling (12hrs)** **Functions and File handling**: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Scope of the Variables in a Function - Global and Local Variables, Lambda functions, Python packages, File I/O handling – filepath, open(), close(), read(), write(), append() methods, file position , renaming and deleting files.	CO3
IV	**Object Oriented Programming in Python (10hrs)** **Object Oriented Programming in Python**: Definition, advantages of OOPs, OOPs principles, Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, and Data hiding. **Error and Exceptions:** Difference between an error and Exception, Handling	CO4

	Exception, tryexcept block, Raising Exceptions, User Defined Exceptions.	
V	**Python for Electronics Engineers (8hrs)** **Python for Electronics Engineers:** Electronic system development life cycle, Raspberry Pi features, Raspbian Operating system, basic commands – Creating, deleting files, directories, listing files and directories, Python IDE on Raspberry Pi, Accessing the board, Basic I/O – Reading analog, digital inputs. Interfacing sensors with Raspberry Pi.	**CO5**

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

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

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

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

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

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

Text books:

1. Python Programming using problem solving Approach by ReemaThareja, Oxford University, Higher Education
2. PovelSolin, Martin Novak, "Introduction to Python Programming", NC Lab Public Computing.
3. Bill Lubanovic, "Introducing Python- Modern Computing in Simple Packages", O'ReillyPublication.
4. Programming the Raspberry Pi: Getting Started with Python, Second Edition, Simon Monk.

Reference books:

1. Jacob Fredslund, ". Introduction to Python Programming".
2. Y.Daniel Liang, "Introduction to programming using python", Pearson.
3. R. NageswaraRao, "Core python programming", Dreamtech.
4. Mark Summerfield, "Programming in Python 3" Pearson Education.
5. Magnus Lie Hetland, "Beginning Python –From Novice to Professional", APress Publication.

e- Resources & other digital material:

1. The official Raspberry Pi Beginner's Guide How to use your new computer, Gareth Halfacree.Available Online:

   https://www.raspberrypi.org/magpi-issues/Beginners_Guide_v1.pdf.

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II Year-I SEMESTER

L	T	P	C
2	0	0	0

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Objectives: The course is introduced

1. To get a knowledge in Indian Philosophical Foundations.
2. To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: After successful completion of the course the students will be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature among difference traditions.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. The essence of Yogic Science for Inclusiveness of society.

UNIT – I

Introduction to Indian Philosophy: Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

UNIT – II Indian Philosophy & Literature:

Vedas Upanishads, schools of Vedanta, and other religion Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India. Indian languages and Literature-II: Northern Indian languages & Philosophical & cultural & literature.

UNIT – III Religion and Philosophy:

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – IV Indian Fine Arts & Its Philosophy (Art, Technology & Engineering):

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.

UNIT – V Education System in India:

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

Suggested Readings:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition'', ISBN: 81246033375,2005
2. "Science in Samskrit", Samskrita Bharti Publisher,ISBN-13:978-8187276333,2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre'', ISBN 81-7450-494-X,2006
4. S. Narain, "Examination in Ancient India", Arya Book Depot,1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher,1989
6. M.Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN-13: 978- 8120810990,2014
7. Chatterjee. S & Dutta "An Introduction to IndianPhilosophy"

II Year-I SEMESTER

L	T	P	C
0	0	3	1.5

ELECTRONIC DEVICES AND CIRCUITS LAB

Course objectives: The student should be able to

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

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

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

Experiments:

1. V-I characteristics of Junction diode.
2. V-I characteristics of Zener diode.
3. Half-Wave Rectifier with and without Capacitor filter
4. Full-Wave Rectifier with and without capacitor filter
5. Bridge Rectifier with and without capacitor filter
6. Zener 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).

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II Year-I SEMESTER **L T P C**
0 0 3 1.5

SIGNALS AND SYSTEMS LAB

S.No	Course Code	Name of the Course	L	T	P	C
8	19ECL302	Signals and Systems Lab	0	0	3	2

Course objectives: The student should be able to

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

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

1. Generate different signals using MATLAB.
2. Understand Fourier Transform/Series and process of sampling using MATLAB.
3. Generate continuous time and discrete time systems using MATLAB.
4. Perform convolution using MATLAB.

Experiments:

1. Introduction to MATLAB covering Relational Operators, Loops & Functions, Matrix Operations.
2. Exercises on understanding complex numbers, Tylor's and Euler's series, finding the roots 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 conversionand 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.

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II Year-I SEMESTER **L T P C**
0 0 3 1.5

PYTHON PROGRAMMING LAB

Course objectives: The student should be able to

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

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

1. **Comprehend** how software easily to be built right out of the box.
2. **Demonstrates** the use of an interpreted language for problem solving through control statements including loops and conditionals.
3. **Practice** with data structures for quick programming solutions.
4. **Demonstrates** software building for real needs by breaking out code into reusable functions and modules.
5. **Comprehend** the software reliability through exception handling.

Experiments:

Section - A

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a Python Script
b) Write a program to purposefully raise Indentation Error and Correct it

Exercise - 2 Control Flow

a) Write a Program for checking whether the given number is a even number or not.
b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . , 1/10
c) Write a program using for loop that loops over a sequence. What is sequence?
d) Find the sum of all the primes below two million.
e) Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

Exercise - 3 - DS

a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure
b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 4 Files

a) Write a program to print each line of a file in reverse order.
b) Write a program to compute the number of characters, words and lines in a file.

Exercise - 5 Functions

a) Find mean, median, mode for the given set of numbers in a list.

b) Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
c) Write a function dups to find all duplicates in the list.
d) Write a function unique to find all the unique elements of a list.

Exercise 6 - Multi-D Lists

a) Write a program to perform addition of two square matrices
b) Demonstrate operations on a bank account of a customer. The operations are deposit(), withdraw(), check balance(), display Details(). Use classes and objects to implement the operations.
c) Demonstrate Single Inheritance in Python with relevant class structure.

Section-B

Problem#1: Pangrams

Roy wanted to increase his typing speed for programming contests. So, his friend advised him to type the sentence "The quick brown fox jumps over the lazy dog" repeatedly, because it is a pangram. (Pangrams are sentences constructed by using every letter of the alphabet at least once.)
After typing the sentence several times, Roy became bored with it. So he started to look for other pangrams.
Given a sentence, tell Roy if it is a pangram or not.

Input Format

Input consists of a string.

Constraints

Length of can be at most and it may contain spaces, lower case and upper case letters. Lower-case and upper-case instances of a letter are considered the same.

Output Format

Output a line containing pangram if is a pangram, otherwise output not pangram.

Sample Input

Input #1

We promptly judged antique ivory buckles for the next prize

Input #2

We promptly judged antique ivory buckles for the prize

Sample Output

Output #1

pangram

Output #2

not pangram

Explanation

In the first test case, the answer is pangram because the sentence contains all the letters of the English alphabet.

Problem# 2: Left Rotation

A left rotation operation on an array of size shifts each of the array's elements unit to the left. For Example, if 2 left rotations are performed on array [1,2,3,4,5], then the array would become

[3,4,5,1,2].

Given an array of n integers and a number, d, perform d left rotations on the array. Then print the updated array as a single line of space-separated integers.

Input Format

The first line contains two space-separated integers denoting the respective values of n (the number of integers) and d (the number of left rotations you must perform).

The second line contains n space-separated integers describing the respective elements of the array's initial state.

Constraints

$1<=n<<10^5$

$1<<d<<n$

$1<<a_i<<10^6$

Output Format

Print a single line of space-separated integers denoting the final state of the array after performing d left rotations.

Sample Input

5 4

1 2 3 4 5

Sample Output

5 1 2 3 4

Explanation

When we perform d=4 left rotations, the array undergoes the following sequence of changes:

[1,2,3,4,5]→ [2,3,4,5,1]→ [3,4,5,1,2] →[4,5,1,2,3] →[5,1,2,3,4]

Thus, we print the array's final state as a single line of space-separated values, which is 5 1 2 3 4.

Problem#3: Time Conversion

Given a time in 12-hour AM/PM format, convert it to military (24 -hour) time.

Note: Midnight is12:00:00AM on a 12-hour clock, and 00:00:00 on a 24-hour clock. Noon is 12:00:00 PM on a 12-hour clock, and 12:00:00 on a 24-hour clock.

Input Format

A single string containing a time in 12-hour clock format (i.e.: hh:mm:ss AM or hh:mm:ss PM), where 01<=hh<12 and 00<=mm, ss<=59.

Output Format

Convert and print the given time in 24-hour format, where 00<=hh<=23

Sample Input

07:05:45PM

Sample Output

19:05:45

Section – C

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

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

   Interface a camera module and store an image/video in a specific location on Raspberry Pi 4B board.

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II Year-II SEMESTER **L T P C**
3 0 0 3

RANDOM VARIABLES AND STOCHASTIC PROCCESSES

Pre-Requisites : Mathematics

Course objectives: The student should be able to

1. To give students an introduction to elementary probability theory, in preparation for courses 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 No	Contents	Mapped CO
I	**THE RANDOM VARIABLE:** 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.**(10hrs)**	**CO1**
II	**OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS:** 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.**(10hrs)**	**CO2**
III	**MULTIPLE RANDOM VARIABLES :** 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.**(08hrs)** **OPERATIONS ON MULTIPLE RANDOM VARIABLES:** Joint 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.**(08hrs)**	**CO3**

IV	**RANDOM PROCESSES– TEMPORAL & SPECTRAL CHARACTERISTICS:** 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.**(12hrs)**	**CO4**
V	**LINEAR SYSTEMS WITH RANDOM INPUTS & MODELLING OF NOISE SOURCES:** 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.**(12hrs)**	**CO5**

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)**

Text books:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 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 and S.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 Application to Signal Processing", Pearson Education, 3rd Edition.
6. George R. Cooper, Clave D. MC Gillem, "Probability Methods of Signal and System Analysis", Oxford, 3rd Edition, 1999.

e- Resources & other digital material:

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

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II Year-II SEMESTER

L	T	P	C
3	0	0	3

ANALOG CIRCUITS

Pre-Requisites:1) Electronic Devices and Circuits 2) 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 and multistage amplifiers.
3. To **familiarize** the concept of feedback in amplifiers and **analysis** of different types of feedback 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 No	Contents	Mapped CO
I	**Linear Wave Shaping:** 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 (**7hrs)** **Nonlinear Wave Shaping:** Diode clippers, Transfer characteristics of clippers, series and shunt clippers, clipping at two independent levels, Clamping operation, Clamping circuit theorem. (**7hrs)**	**CO1**
II	**Multistage Amplifiers:** 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. (**7hrs)** **Transistor at High Frequency:** 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, $f\alpha$, $f\beta$ and unity gain bandwidth, Analysis of common source and common drain amplifiers at high frequencies. (**7hrs)**	**CO2**
III	**Feedback Amplifiers:** 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. (**10hrs)**	**CO3**
IV	**Oscillators:** Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, crystal oscillators. (**8hrs)**	**CO4**

V	**Large Signal Amplifiers:** Class A Power Amplifier- Series fed and Transformer coupled Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principles of Class AB and Class –C Amplifiers. (**7hrs)** **Tuned Amplifiers:** Introduction, single Tuned Amplifiers – Q-factor, frequency response of tuned amplifiers, Concept of stagger tuning and synchronous tuning. (**7hrs)**	**CO5**

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)**

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, Pearson Education.
3. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, Mothiki S Prakash Rao McGraw-Hill, Second Edition, 2007.
4. Solid State Pulse circuits - David A. Bell, PHI, 4th Edn., 2002

e- Resources & other digital material:

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

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II Year-II SEMESTER

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ELETROMAGNETIC FIELDS AND WAVES

Pre-Requisites : Signals and systems

Course objectives: The student should be able to

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

Unit No	Contents	Mapped CO
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.	CO1
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.	CO2
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.	CO3

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.	**CO4**
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.	**CO5**

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.

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, Universities Press (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, 2nd ed., 2005.
3. Schaum's Outline of Electromagnetics - Joseph Edminister and Mahmood Nahvi, fourth edition

e- Resources & other digital material:

1. https://nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/108/104/108104087/
3. https://nptel.ac.in/courses/117/103/117103065/
4. https://nptel.ac.in/courses/115/101/115101005/
5. https://nptel.ac.in/courses/108/106/108106152/

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II Year-II SEMESTER

L	T	P	C
2	0	0	2

DIGITAL SYSTEM DESIGN WITH VHDL

Pre-Requisites : Digital Circuits and Logic Design

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 No	Contents	Mapped CO
I	**Digital Logic Families**- 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, comparison of logic families.	CO1
II	**Introduction to VHDL-**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.	CO2
III	**Digital Design Using VHDL-**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.	CO3
IV	**Combinational Logic IC Design**- 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.	CO4
V	**Sequential Logic IC Design-** 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.	CO5

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.

CO2: Studying basics of HDL and Programming models of VHDL.

CO3: Implementing digital systems using VHDL.

CO4: Implementing the Combinational logic using ICs and VHDL code.

CO5: Modeling of Sequential circuits using ICs and VHDL code.

Text books:

1. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.
2. Circuit Design with VHDL - V. A. Pedroni, MIT Press, Cambridge, 2004.
3. VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.
4. Digital Logic Circuit Analysis and Design - V. P. Nelson, H.T. Nagle, B.D. Carroll, and D. Irwin, 1st Edition, Prentice Hall International, 1995.

Reference books:

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

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II Year-II SEMESTER

L	T	P	C
3	0	0	3

ANALOG AND DIGITAL COMMUNICATIONS

Pre-Requisites: Signals& Systems, Random Variables and Stochastic Process

Course objectives: The student should be able to

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 No	Contents	Mapped CO
I	**AMPLITUDE MODULATION** Introduction to 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 side band modulation, Generation of VSB Modulated wave, Comparison of AM Techniques- Power & BW, Radio Receiver: Receiver Types - Tuned radio frequency receiver, Super heterodyne receiver. AM receivers.	CO1
II	**ANGLE MODULATION** Basic concepts, Frequency Modulation - Single tone frequency modulation, Spectrum, Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM; Generation of FM Waves - Direct FM, Indirect FM. Detection of FM Waves – Foster-Seeley Discriminator, PLL; Super heterodyne FM receiver; Noise in SSBSC& DSBSC Systems, Noise in AM System, Noise in Angle Modulation Systems, Comparison of AM and FM Systems.	CO2
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, Adaptive delta modulation. Noise in PCM and DM systems, Comparison of PCM and DM systems.	CO3
IV	**DIGITAL MODULATION TECHNIQUES** Introduction, Binary schemes: Generation and Demodulation of ASK, FSK, PSK, DPSK; M-ary schemes; Data Transmission - Base band signal receiver,	CO4

	Probability of error, Matched filter, Calculation of error probability of BASK, BPSK, BFSK, QPSK schemes.	
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/N trade off.	**CO5**

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 reliable transmission of digital representation of signals and information over the channel. **(Analyzing)**

Text books:

1. S. Haykin, Communication Systems (4/e), Wiley, 2001.
2. Taub, Herbert and Donald L. Schilling, Principles of Communication Systems. Tata McGraw-Hill Education, 2008.
3. B. P. Lathi, Modern Digital and Analog Communications Systems, (3/e), Oxford University 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 Error function / 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

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II Year-II SEMESTER

L	T	P	C
2	0	0	2

CONTROL SYSTEMS

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

Course objectives: The student should be able to

1. To introduce the concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems, and concepts of feedback.

2. To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis.

3. To develop the acquaintance in analyzing the system response in time-domain and frequency domain in terms of various performance indices.

4. To analyze the system in terms of absolute stability and relative stability by different approaches.

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 controllability and observability.

Unit No	Contents	Mapped CO
I	**Introduction**: System Control System, Open Loop Control System, Closed loop Control System, Different Examples. **Effects of Feedback:** Feedback Characteristics and its advantages, Linearizing effect of feedback. **Mathematical models of Physical Systems:** Differential equations of physical systems, Transfer functions, Block diagram Algebra, Signal flow graphs with illustrative examples.	**CO1**
II	**Controller Components**: DC Servomotor (Armature Controlled and Field Controlled) with necessary derivation for transfer function, AC Servomotor and its transfer function, AC Tachometer, Potentiometer, Synchronous, 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.	**CO2**
III	**Concepts of Stability and Algebraic Criteria:** The concept of Stability, Necessary Conditions for Stability, Routh-Hurwitz Stability Criterion, Relative stability analysis. **The Root Locus Technique:** Introduction, The Root Locus concepts, Construction of Root Loci.	**CO3**
IV	**Frequency response analysis:** Introduction, Correlation between time and frequency response, frequency domain specifications, Polar Plots, Bode Plots, Nyquist Stability Criterion.	**CO4**

V	**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.	**CO5**

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 models of 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.

Text books:

1. I. 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, Eigth Edition.
2. PadmaRaju and Reddy: Instrumentation and Control Systems ", McGrawHill Education ,2016.

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II Year-II SEMESTER

L	T	P	C
0	0	3	1.5

ANALOG CIRCUITS LAB

Perform design experiments (from 1 to 8) using discrete components and perform design and simulation experiments (from 9 to 11) using any PSPICE simulators or any equivalent software. Minimum of ten experiments to be done in both hardware 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 and Bandwidth 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 the frequency of oscillation.
9. Determine Gain and Bandwidth from its frequency response curve of a darlington amplifier.
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

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II Year-II SEMESTER

L	T	P	C
0	0	3	1.5

ANALOG AND DIGITAL COMMUNICATIONS LAB

List of Experiments:

Using MATLAB

1. AM Modulation and Demodulation
2. FM Modulation and Demodulation
3. Pulse Code Modulation
4. FSK Generation and Detection
5. PSK Generation and Detection
6. DPSK Generation and Detection

Using Simulink

7. AM Modulation and Demodulation
8. FM Modulation and Demodulation
9. Pulse Code Modulation
10. FSK Generation and Detection
11. PSK Generation and Detection
12. DPSK Generation and Detection

Using Hardware

13. AM Modulation and Demodulation
14. FM Modulation and Demodulation
15. Pulse Code Modulation
16. FSK Generation and Detection
17. PSK Generation and Detection
18. DPSK Generation and Detection

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II Year-II SEMESTER

L	T	P	C
0	0	3	1.5

DIGITAL SYSTEM DESIGN WITH VHDL LAB

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.

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 also with 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.

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

Equipment/Software required:

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

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III Year-I SEMESTER

L	T	P	C
3	0	0	3

LINEAR IC APPLICATIONS

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 IC's.
5. To understand the various types of Digital to Analog and Analog to Digital converters

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Differential Amplifier and Operational Amplifier Characteristics: [15hours]** **Differential Amplifier and Operational Amplifier Characteristics:** Internal Block Diagram of various stages of Op-Amp and Role of each Stage. Different configurations of differential amplifiers (Qualitative), DC & AC Analysis of Differential Amplifier using BJT and FET, Basic Current mirror circuit using BJT and FET, Current Repeater Circuits using BJT & FET. 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, Measurements of 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.	**CO1**
II	**Linear and Non-Linear applications of Operational Amplifier: [11 hours]** Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, Log and Anti log Amplifiers, Half wave and Full wave Precision rectifiers. Comparators, Multivibrators, Triangular and Square wave generators, Schmitt trigger.	**CO2**

III	**Active Filters, Analog Multipliers, Oscillators and Modulators: [12 hours]** Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Bandpass, Band reject and all pass filters. Four Quadrant Multiplier, IC 1496, Sample & Hold circuits. Introduction to Oscillators, RC Phase shift oscillator, Wien Bridge Oscillator.	**CO3**
IV	**Timers & Phase Locked Loops: [13 hours]** Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566).	**CO4**
V	**Data Converters and its applications:[13 hours]** Introduction, basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs - Parallel comparator type ADC, Counter type ADC, Successive approximation ADC and Dual slope ADC. Introduction to delta sigma ADC.DAC and ADC Specifications (including DNL and INL), Specifications of AD 574 (12-bit ADC).	**CO5**

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.
{Understand level, KL2}

CO2 **Illustrate the** linear and nonlinear applications using op-amp.
{Apply level, KL3}

CO3 **Analyze and Design** active filters, Modulators and oscillators using Op-Amp.
{Analysis, KL4}

CO4 **Interpret** the internal structure and operations of different analog IC's
{Understand level, KL2}

CO5 **Construct** the various Digital to Analog and Analog to Digital Converters.
{Apply level, KL3}.

Text books:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1987.
3. 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 Amplifiers & Linear Integrated Circuits–R.F.Coughlin& FredrickDriscoll, 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.
5. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/108/101/108101094/
2. https://nptel.ac.in/courses/117/101/117101106/

III Year-I SEMESTER

L	T	P	C
3	0	0	3

MICROPROCESSORS & MICROCONTROLLERS

Pre-Requisites: STLD, Computer Architecture and Organisation

Course Objectives:

1. To acquire knowledge about microprocessors, and study the Architectures of 16-bit Microprocessors.
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

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**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. **12 Hours**	**CO1**
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. **13 Hours**	**CO2**
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. **13 Hours**	**CO3**
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. **13 Hours**	**CO4**

V	**ARM Architectures and Processors**: ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, functions and interfaces. **PIC Microcontroller:** Introduction, Characteristics of PIC Microcontroller, PIC Microcontroller Families **Basic features and comparison of ARM, PIC, AVR, Arduino, Raspberry Pie Microcontrollers.** **13 Hours**	**CO5**

Course Outcomes:

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 and operation. **{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}**

Learning Resources

TEXTBOOKS:

1 .Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.

2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 2-Edition, 2011.

3. 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/

III Year-I SEMESTER

L	T	P	C
3	0	0	3

ANTENNAS & WAVE PROPAGATION

Pre-Requisites: Electromagnetics Fields and Waves

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

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**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. **14 hrs**	**CO1**
II	**THIN LINEAR WIRE ANTENNAS:** Retarded Potentials, Basic Antenna Elements, Radiation from 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. **14 hrs**	**CO2**
III	**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. **16 hrs**	**CO3**

IV	**VHF, UHF AND MICROWAVE ANTENNAS** **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) **10 hrs**	**CO4**
V	**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. **10 hrs**	**CO5**

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Identify** the Antenna Parameters
CO2	**Design and Analyze** the wire antenna and its corresponding radiation characteristics
CO3	**Design and Analyze** the various forms of Antenna Arrays
CO4	**Quantify** the various fields radiated by the microwave antennas
CO5	**Identify** the characteristics of radio wave propagation

III Year-I SEMESTER

L	T	P	C
3	0	0	3

VLSI DESIGN

Pre-Requisites: Basic Chemical Processes, Analysis of Analog and Digital Circuits

Course Objectives:

1. Apply the electrical properties of CMOS and Bi-CMOS 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 operational aspects of the MOS transistors to analyze the design of single stage amplifiers
4. Understand the CMOS static and dynamic analytical aspects to design combinational and sequential circuits.
5. Build a strong knowledge on the fundamentals of FPGA design structures and their applications.

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**IC TECHNOLOGY AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS 17Hrs** **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 Diagrams Examples	**CO1**
II	**BASIC CONCEPTS AND SCALING OF MOS CIRCUITS 12Hrs** **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, Transistor switches. **Scaling:** Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to subthreshold currents, Limits on logic levels and supply voltage due to noise, Limits due to current density,	**CO2**

	Some architectural issues, Introduction to switch logic and Gate logic	
III	**BASIC BUILDING BLOCKS OF ANALOG IC DESIGN 10Hrs** Regions of operation of MOSFET, Modelling of transistor, body bias effect, Channel Length Modulation, single stage amplifier with resistive load, single stage amplifier with diode connected load, Common Source amplifier, Common Drain amplifier, Common Gate amplifier, Cascode Amplifiers.	**CO3**
IV	**CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN 13Hrs** **Static CMOS Design:** Complementary CMOS, Ratioed Logic, Pass-Transistor Logic. **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, Latch based design, multiplexer based latches, Master-Slave Based Edge Triggered Register, clock to q delay, setup time, hold time, Clocked CMOS register. Cross coupled NAND and NOR, SR Master Slave register, Pipelining	**CO4**
V	**INTRODUCTION TO PLDs AND ADVANCED TECHNOLOGIES 12Hrs** **Introduction to PLDs**: Overview of PLDs, CPLD: Introduction to CPLD, SPLD versus 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 **Advanced Technologies:** Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology, FinFET, TFET.	**CO5**

Course Outcomes:

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}**

Learning Resources

Text books:

1. D. A. Pucknell and K. Eshraghian, Basic VLSI Design, (3/e), PHI Learning Pvt. Ltd., 2009.
2. B. Razavi,Design of Analog CMOS Integrated Circuits, McGraw Hill, 2003.
3. J. M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits, (2/e), 2003.
4. C. H. Roth, L. K. John and B. K. Lee, Digital Systems Design using Verilog, Cengage Learning, 2016.

Reference books:

1. K. Eshraghian, D. A. Pucknell and S. Eshraghian, Essentials of VLSI Circuits and Systems, 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 on Hardware, APress, 2017.
4. W. Wolf, FPGA-based System Design, Prentice Hall Modern Semiconductor Design Series, 2004.

E-Resources & other digital material:

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 Electrical Engineering, IIT Madras.
   http://www.nptelvideos.in/2012/12/digital-vlsi-system-design.html

III Year-I SEMESTER

L	T	P	C
3	0	0	3

OOPS THROUGH JAVA
(Open Elective-1)

Unit – I: Introduction to OOPS Concepts, Classes and Strings

Differences between C and Java, History of 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-line arguments.

Unit – II: Classes, Inheritance, Interfaces, Packages

Classes: Classes, Objects, Methods, Constructors, Method and Constructor Overloading, this and static keywords, Access modifiers, inner classes.

Inheritance: Need of inheritance, types, super keyword, abstract classes, final keyword, interfaces, Packages.

Unit – III: Exception Handling and I/O Streams

Exception Handling: Exception, Keywords-try, catch, throw, throws, finally.

Stream based I/O: Byte streams and Character streams, reading console Input and Writing Console Output, Reading and writing Files, Random access file operations.

Unit – IV: Multithreading, Applet

Multithreading: Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiple threads, Synchronization.

Applet: Applet life cycle and its methods, Creation and execution of an Applet, passing parameters to an Applet

Unit – V: GUI Programming, Event Handling

GUI Programming: Difference between AWT & Swing, AWT & Swing components-Button, Checkboxes, Radio Buttons, Choice Buttons, Labels, Text Fields

Event Handling- Event delegation model, sources of event, Event Listeners, adapter classes.

TEXT BOOKS:

1. Java The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9 th Edition, 2016

REFERENCE BOOKS:

1. “Java – How to Program”, Paul Deitel, Harvey Deitel, PHI.

2. “Core Java”, NageswarRao, Wiley Publishers.

3. “Thinking in Java”, Bruce Eckel, Pearson Education

4. “A Programmers Guide to Java SCJP”, Third Edition, Mughal, Rasmussen, Pearson.

III Year-I SEMESTER

L	T	P	C
3	0	0	3

COMPUTER NETWORKS

Pre-Requisites: MFCS, Data Structures

Course Objectives:

1. To understand OSI and TCP/IP reference models and Example networks, network models and line coding techniques.
2. To understand the Error Control, Flow Control and Medium Access Control Protocols
3. To Compute optimal path using Routing Algorithms.
4. To understand the concepts of reliable unreliable transmission
5. To acquire the knowledge on various application layer protocols

UNIT-I: Introduction to Computer Networks and Physical Layer 11Hrs

Introduction: Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, Network Topologies WAN, LAN, MAN. Reference models- The OSI Reference Model- Critic of OSI Reference model, TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, Example Networks. Bit rate, Baud rate. Line Coding Techniques: Unipolar (eg. NRZ scheme), Polar (eg. NRZ-L, NRZ-I, RZ, and Biphase – Manchester and differential Manchester).Bipolar.

UNIT-II : Data Link Layer 13Hrs

Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame.

UNIT– III: Network Layer 11Hrs

Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol(IP):Forwarding and Addressing in the Internet-Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6,ARP, RARP Protocols.

UNIT-IV: Transport Layer 14Hrs

Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of

Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control.

UNIT – V: Application Layer **11Hrs**

Application Layer: Principles of Networking Applications – Network Application Architectures, Processes Communication, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages, Network Security.

Advanced Topics (Content Beyond syllabus)

1. Layered Architectures in IoT (1 hr.)
2. CISCO Switches. (1 hr)
3. Network Clustering (1 hr.)
4. Protocols for Wireless Sensor Networks (1 hr.)

Text Books:

1. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6thEdition , Pearson,2017.
2. Data Communications and Networking Behrouz A.Forouzan4th Edition McGraw Hill Education,2017.

References:

1. Data communication and Networks - BhusanTrivedi, Oxford university press,2016
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, PearsonEducation,2003.
3. Understanding Communications and Networks,3rdEdition,W.A.Shay,CengageLearning,2003.

Web Resources:

1. https://youtube.com/playlist?list=PLbRMhDVUMngfpeFloB7kyiA40EptH1up
2. https://www.cisco.com/c/en/us/support/docs/ip/routing-information-protocol-rip/13788-3.html

Course Outcomes:

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

CO1: To understand OSI and TCP/IP reference models and Example networks, characteristics of transmission media and classify multiplexing techniques (L1)

CO2: To understand the Error Control, Flow Control and Medium Access Control Protocols

CO3: To Compute optimal path using Routing Algorithms.

CO4: To understand the concepts of reliable unreliable transmission

CO5: To acquire the knowledge on various application layer protocols (L3)

III Year-I SEMESTER

L	T	P	C
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LINER IC APPLICATIONS LAB

Pre-Requisites: Electronic Devices and Circuits Lab

List of experiments

Minimum Twelve Experiments to be conducted

1. Study of OP AMPs – IC 741, IC 555, IC 565, IC 566, IC 1496 – functioning, parameters and Specifications
2. Design an inverting adder, non-inverting adder, subtractor and comparator using operational amplifier.
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 a 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.

Equipment required for Laboratories:

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 essential components.
8. Analog IC Tester

III Year-I SEMESTER

L	T	P	C
0	0	3	1.5

MICROPROCESSORS AND MICROCONTROLLERS LAB

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

III Year-I SEMESTER

L	T	P	C
0	0	3	1.5

VLSI DESIGN LAB

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 the Laboratory

1. Realization of Logic gates

Design and Implementation of the following:

2. 4-bit ripple carry and carry look ahead adder using behavioural, dataflow and structural modeling
3. a) 16:1 mux through 4:1 mux b) 3:8 decoder realization through 2:4 decoder
4. 8:3 encoder
5. 8-bit parity generator and checker
6. J-K and T Flip-Flops
7. 8-bit synchronous up-down counter
8. 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.

III Year-II SEMESTER

L	T	P	C
3	0	0	3

DIGITAL SIGNAL PROCESSING

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 & Learn the concepts of DSP Processors

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to Discrete Time Signals & Systems. (12 Hrs.)** Introduction to Digital Signal Processing, Discrete time Signals, Signal Processing, Discrete time Systems, Linear Shift Invariant Systems, Condition for Stability. Linear Constant Coefficient Difference Equations, Discrete Time Fourier Transformation and its Properties, Linear Convolution, Review of Z-Transforms –Solutions of Difference Equations using Z-Transforms, Stability Criteria in Z-Transform.	**CO1**
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 , Linear Convolution using Circular Convolution. Introduction to FFT, Efficient Computation of DFT, Radix-2 Algorithms- Decimation in Time and Decimation in Frequency Algorithms, Inverse DFT using FFT .	**CO2**
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 Digital frequency transformations. Basic structures of IIR systems, Transposed forms	**CO3**
IV	**Design And Realization of FIR filters (14 Hrs.)** Introduction to FIR Filters, Characteristics of FIR Filters, Frequency Response, Design of FIR Filters- Fourier Series Method , Frequency Sampling method and Window Method. Basic structures of FIR systems, Lattice structures, Lattice-ladder structures.	**CO4**
V	**Multirate Digital Signal Processing& Introduction to DSP processors (12 Hrs.)** Introduction, Down Sampling, Decimation, Spectrum of Down Sampling, Up Sampling, Interpolation, Spectrum of Up Sampling, Cascading Sample Rate Converters, Sampling Rate Conversion, Applications of Multirate DSP.	**CO5**

	Introduction to DSP processors, Basic architecture of TMS320 6713 DSP processor, Applications of DSP processors - Detection of QRS complex of ECG signals, Generation and detection of DTMF signals, Speech compression using Linear Predictive Coding.	

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyze the Discrete Time Signals and Systems& Apply the difference equations concept in the analysis of Discrete time systems
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	Design a Digital filter (FIR&IIR) from the given specifications
CO4	Able to realize the digital filters
CO5	Know the need of Multirate Processing, Use the Multirate Processing concepts in various applications &Learn the concepts of DSP Processors

Learning Resources

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 and Applications,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

III Year-II SEMESTER

L	T	P	C
3	0	0	3

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Pre-Requisites: Basic Science and Humanities

Course Objectives:

1. To equip the students with the basic inputs of managerial economics and demand concepts.
2. To understand the concepts of production and cost for various business decision.
3. To understand the different types of market, market structures & pricing strategies and their applications in business decision making and to know the different forms of Business organization and the concept of Business Cycles.
4. To understand the fundamental of accounting and analysis of accounting statements for managerial decision making.
5. To understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

UNIT – I Introduction to Managerial Economics and demand Analysis: 10 Hrs

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting.

UNIT - II Theory of Production and Cost Analysis: 13 Hrs

Production Function – Isoquant and Isocost, MRTS, Least Cost Combination of Inputs - Laws of Returns to scale - Internal and External Economies of Scale, Cost Analysis: Cost concepts, Cost & output relationship in short run & long run - Break-even Analysis (BEA)-Determination of Break-Even Point - Significance and limitations.

UNIT – III Introduction to Markets, Pricing Policies & Types of Business Organization and Business Cycles: 12 Hrs

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, and Internet Pricing: Flat Rate Pricing, Usage sensitive pricing and Priority Pricing. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – Business Cycles: Phases of Business Cycles.

UNIT – IV Introduction to Financial Accounting & Analysis: 13 Hrs

Financial Accounting and analysis: Accounting –significance -- Book Keeping-Double entry system –Journal- Ledger- Trial Balance- Final Accounts with simple adjustments.

Financial Statement Analysis through ratios: Ratio-analysis of financial statement using different ratios (Liquidity -Profitability- Solvency -Activity ratios).

UNIT - V Capital and Capital Budgeting: 12 Hrs

Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).

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

CO1: To equipped with the knowledge of estimating the Demand and demand elasticities for a product.

CO2: The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.

CO3: To understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.

CO4: To prepare Financial Statements and the usage of various Accounting tools for analysis.

CO5: To evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

Text Books:

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011.

2. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011.

3. Prof. J.V. Prabhakara rao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

Reference Books:

1. V. Maheswari : Managerial Economics, Sultan Chand.

2. Suma Damodaran : Managerial Economics, Oxford 2011.

3. Dr. B. Kuberudu and Dr. T. V. Ramana : Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.

4. Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.

5. Sanjay Dhameja : Financial Accounting for Managers, Pearson.

6. Maheswari: Financial Accounting, Vikas Publications.

7. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012.

Web links:

1. www.managementstudyguide.com
2. www.tutorialspoint.com
3. www.lecturenotes.in

III Year-II SEMESTER

L	T	P	C
3	0	0	3

MICROWAVE ENGINEERING

Pre-Requisites: Analog and Digital Communications, Electromagnetic Waves and Transmission Lines, Antennas and Wave Propagation

Course Objectives:

1. Understand the fundamental characteristics of rectangular waveguides through electromagnetic field analysis.
2. Understand the fundamental characteristics of circular waveguides and Microstrip antenna through electromagnetic field analysis.
3. Understand the basic properties of waveguide components and applications
4. Understand the function, design, and integration of the major microwave tubes
5. Understand the design of microwave solid-state devices and Microwave test bench setup for measurements.

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Microwave Transmission Lines:** Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Dominant and Degenerate Modes. Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations. Impossibility of TEM mode. Related Problems.	**CO1**
II	**Circular Waveguides:** Introduction, Circular Waveguides- TE/TM and TEM mode analysis, Dominant and Degenerate Modes. Advantages and Disadvantages, Q factor and Coupling Coefficients, Applications, Related Problems. **Microstrip Antenna Design:** Basic geometrical configuration of Microstrip patch antenna, features of microstrip antenna, Radiation mechanism, advantages and limitations of microstrip antenna, Design of rectangular microstrip patch antenna.	**CO2**
III	**Waveguide Components And Applications:** Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Scattering Matrix– Significance, Formulation and Properties. S-Matrix Calculations for – 2 port Junction, E-plane and H-plane Tees, Magic Tee, and Directional Couplers. S-Matrix Calculations for Gyrator, Isolator, Circulator, Related Problems.	**CO3**

IV	**Microwave Tubes:** Limitations and Losses of conventional tubes at microwave frequencies. O-type tubes : 2 Cavity Klystrons – Structure, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for o/p Power and Efficiency, Applications, Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Mathematical Theory of Bunching, Power Output, Efficiency, Electronic Admittance; Oscillating Modes and Output Characteristics, Electronic and Mechanical Tuning, Applications, Related Problems.	**CO4**
V	**Microwave Solid State Devices:** Introduction, Classification, Applications. Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes. Avalanche Transit Time Devices – Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and Characteristics. **Microwave Measurements:** Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, Q-factor, VSWR, Impedance Measurement.	**CO5**

Learning Resources:

Text Books:

1.Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition,1994.
2. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.

References:

1. Microwave Principles – Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004
2. Microwave Engineering- Annapurna Das and SisirK.Das, Mc Graw Hill Education, 3rdEdition.
3. Microwave and Radar Engineering-M.Kulkarni, Umesh Publications, 3rdEdition.

III Year-II SEMESTER

L	T	P	C
3	0	0	3

CELLULAR AND MOBILE COMMUNICATIONS

(Professional Elective-1)

Pre-Requisites: Analog & Digital Communications, Antennas and Wave Propagation.

Course Objectives:

1. Understand the basic cellular concepts and elements of cellular systems.
2. Understand the types of interferences and types of cell site and mobile unit antennas.
3. Understand of cell coverage for signal and traffic at various environments.
4. Understand of frequency management, channel assignment, types of handoffs and dropped calls.
5. Understand the architectures of GSM, 3G cellular systems and advanced wireless standards.

Syllabus		
Unit	**Contents**	**Mapped CO**
I	**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, analog and digital cellular systems. **ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN:** General description of the problem, concept of frequency channels, number of channels in a cellular system, co channel interference reduction factor, desired C/I from a normal case in a omni directional antenna system, handoff Mechanism, consideration of the components of cellular system. cellular structures: macro, micro, pico and femto cells; cell splitting, cell sectoring	**CO1**
II	**INTERFERENCE:** Types of interferences, introduction to co channel interference, real time co channel interference, co channel measurement, antenna parameters and their effects, diversity receiver, non-co channel interference-different types. **CELL SITE AND MOBILE ANTENNAS:** Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, and mobile antennas.	**CO2**
III	**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.	**CO3**
IV	**FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:** Numbering and grouping, setup access and paging channels, channel assignments to cell sites and mobile units: fixed channel and non-fixed channel	**CO4**

	assignment, channel sharing and borrowing, overlaid cells. **HANDOFFS AND DROPPED CALLS:** Concept of handoff, handoff initiation, types of handoff, probability of handoff, delaying handoff, power difference handoff, controlling handoff, creating handoff, forced handoff, mobile assisted handoff, soft handoff, intersystem handoff, vehicle locating methods, introduction to dropped call rates and their evaluation.	
V	**DIGITAL CELLULAR NETWORKS:** GSM architecture, GSM channels, multiple access schemes; TDMA, CDMA, OFDMA; architecture of 3G cellular systems, 3G and 4G Wireless Standards, GPRS, WCDMA, LTE, Wi-MAX, Introduction to 5G standards.	**CO5**

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Understand** inner workings of cellular system and **Describe** the elements of cellular systems.
CO2	**Categorize** different interferences and to **Evaluate** different antennas using at cell site and mobile units
CO3	**Analyze** cell coverage for signal and traffic in various environments.
CO4	**Discriminate** the frequency management and channel assignments in cellular system and **Plan** the handoffs in cellular systems
CO5	**Create** and **Develop** new technologies in wireless cellular systems.

Learning Resources

TEXT BOOKS:

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2nd Edn.,2006.
2. Principles of Mobile Communications – Gordon L. Stuber, Springer International2nd Edition, 2007.
3. Advanced Wireless Communications-4G By. Savo G Glisic, John Wiley & Sons Publication 2ndEdition

REFERENCES:

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 Weihua Zhqung, PHI, 2005.
5. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.
6. Fundamentals of Wireless Communication-David Tse and Pramod Viswanath, Cambridge University Press

E-Resources & other digital material:

Lecture Series on Wireless Communication by Dr.Ranjan Bose, Department of Electrical Engineering,IIT Delhi.

http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/EC632.pdf

http://accessengineeringlibrary.com/browse/wireless-and-cellular-communications-third-edition.

http://www.slideshare.net/pratheeshnair85/cellular-mobile-communication

III Year-II SEMESTER

L	T	P	C
3	0	0	3

EMBEDDED AND REAL-TIME OPERATING SYSTEMS

(Professional Elective-2)

Pre-Requisites: Computer Architecture

Course Objectives:

The student should be made to:

- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems

Syllabus		
Unit	**Contents**	**Mapped CO**
I	**INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 12 Hrs** Complex systems and microprocessors – Embedded system design process – Design example: Model train controller – Instruction sets preliminaries – ARM Processor – CPU: programming input and output – Supervisor mode, exceptions and traps – Co- processors – Memory system mechanisms – CPU performance – CPU power consumption.	**CO1**
II	**EMBEDDED COMPUTING PLATFORM DESIGN 12 Hrs** The CPU Bus – Memory devices and systems – Designing with computing platforms – Consumer electronics architecture – Platform level performance analysis – Components for embedded programs – Models of programs – Assembly, linking and loading – Compilation techniques – Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size – Program validation and testing.	**CO2**
III	**PROCESSES AND OPERATING SYSTEMS 12 Hrs** Introduction – Multiple tasks and multiple processes – Multirate systems – Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance – power optimization strategies for processes – Example Real time operating systems: POSIX-Windows CE.	**CO3**
IV	**SYSTEM DESIGN TECHNIQUES AND NETWORKS 10 Hrs** Design methodologies: Design flows – Requirement Analysis – Specifications – System analysis and architecture design – Quality Assurance – Distributed embedded systems - MPSoCs and shared memory multiprocessors.	**CO4**

V	**CASE STUDY** **10Hrs** Data compressor – Alarm Clock – Audio player – Software modem- Digital still camera - Telephone answering machine-Engine control unit – Video accelerator.	**CO5**

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Describe the architecture and programming of ARM processor.
CO2	Outline the concepts of embedded systems.
CO3	Explain the basic concepts of real time Operating system design.
CO4	Use the system design techniques to develop software for embedded systems.
CO5	To implement a model real-time application using embedded-system concepts

Learning Resources

Text books:

1. Marilyn Wolf, Computers as Components – Principles of Embedded Computing System Design, Third Edition Morgan Kaufmann Publisher, 2012. (Unit I, II, III, V)
2. Jane W.S.Liu, Real Time Systems, Pearson Education, Third Indian Reprint,2003 Unit IV).

Reference books:

1. Lyla B.Das, Embedded Systems : An Integrated Approach Pearson Education,2013.
2. Jonathan W.Valvano, Embedded Microcomputer Systems Real Time Interfacing,Third Edition Cengage Learning, 2012.
3. David. E. Simon, An Embedded Software Primer, 1st Edition, Fifth Impression,Addison-Wesley Professional, 2007.
4. Raymond J.A. Buhr, Donald L.Bailey, An Introduction to Real-Time Systems-From Design to Networking with C/C++, Prentice Hall, 1999.
5. C.M. Krishna, Kang G. Shin, Real-Time Systems, International Editions, McGraw Hill 1997
6. K.V.K.K.Prasad, Embedded Real-Time Systems: Concepts, Design andProgramming, Dream Tech Press, 2005.
7. Sriram V Iyer, Pankaj Gupta, Embedded Real Time Systems Programming, TataMc Graw Hill, 2004.

III Year-II SEMESTER

L	T	P	C
0	0	3	1.5

DIGITAL SIGNAL PROCESSING LAB

List of Experiments:

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

III Year-II SEMESTER

L	T	P	C
0	0	6	3

Mini Project

IV Year-I SEMESTER

L	T	P	C
2	0	0	2

MANAGEMENT SCIENCE

Pre-Requisites: Basic Sciences and Humanities

Course Objectives:

1. To familiarize with the process of management, principles, and basic concepts of Organization.
2. To understand the tools of operations and Materials Management.
3. To provide conceptual knowledge on functional management like Human resource management and Marketing management.
4. To impart knowledge on project management.
5. To provide basic insight into selected contemporary management practices and Strategic Management

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to Management: 12 Hrs** Concept –nature and importance of Management –Generic Functions of Management – Principles and Types of Management –Evolution of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization – Organizational typology.	**CO1**
II	**Operations Management: 12 Hrs** Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C-chart) Simple problems- Material Management: Need for Inventory control-EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis), Justin- Time (JIT) system, Total Quality Management (TQM), Six sigma, Supply chain management.	**CO2**
III	**Functional Management: 12 Hrs** Concept of HRM, HRD and ER (Employee Relations) - Functions of HR Manager- Compensation Management plans – Job Evaluation and Merit Rating - Marketing Management: Functions of Marketing – Marketing strategies based on product Life Cycle, Channels of distributions.	**CO3**
IV	**Project Management: 12 Hrs** (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).	**CO4**
V	**Strategic Management: 12 Hrs** Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy Alternatives, Basic concepts of MIS, ERP,	**CO5**

	Capability Maturity Model(CMM) Levels, Balanced Score Card.	

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Apply management and motivation theories to renovate the practice of management.
CO2	Explain concepts of quality management and use process control charts, concepts and tools of quality engineering in the design of products and process controls.
CO3	Appraise the functional management challenges associated with high levels of change in the organizations.
CO4	Identify activities with their interdependency and use scheduling techniques of project management PERT/CPM
CO5	Develop global vision and management skills both at strategic level and interpersonal level.

Learning Resources

Text books:

1. Management Science, Aryasri, Tata McGraw Hill, 2014.
2. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Introduction to Management Science' Cengage, Delhi, 2012.
3. G Srinivasa Rao: 'Management Science', The Hi-Tech Publishers, 2004.

Reference books:

1. Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshan ul Haque , 17th Edition, Pearson Education/ Prentice Hall of India, 2018.
2. Human Resource Management: Gary Dessler, 14th Edition, pearson 2015.
3. Production and Operations Management: S N Chary, TMH, 2019, 6e.
4. Project Planning and Control with PERT and CPM: Dr. B. C. Punmia, K. K Khandelwal, Laxmi Publication, 2017, 4th Edition.
5. Strategic Management: John A Pearce, Richard B Robinson, TMH 12th Edition, 2017.Signal Processing – Ramesh babu, Sci Tech publications

IV Year-I SEMESTER

L	T	P	C
3	0	0	3

RADAR ENGINEERING
Professional Elective -III

Pre-Requisites: Analog & Digital Communications, Antennas and Wave Propagation, Microwave Engineering.

Course Objectives:

1. The basic principle of radar and range equation
2. Different types of radars: CW, FM-CW, MTI and Pulse Doppler Radars
3. Understand the different tracking techniques for radar
4. Understand the characteristics of a Matched Filter receiver and its performance
5. Understand the different types of displays, duplexers and antennas used in radar systems

Syllabus

Unit No	Contents	Mapped CO
I	**BASICS OF RADAR:** Introduction, Maximum Unambiguous Range, Simple Radar Range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems. **RADAR EQUATION:** Modified Radar Range Equation, SNR, Probability of detection, Probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. **16 Hours**	**CO1**
II	**CW AND FREQUENCY MODULATED RADAR:** Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems. **FM-CW RADAR:** Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Multiple Frequency CW Radar. **12 Hours**	**CO2**
III	**MTI AND PULSE DOPPLER RADAR:** Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Nth Cancellation. Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar. **10 Hours**	**CO3**
IV	**TRACKING RADAR:** Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers. **09 Hours**	**CO4**

V	**RECEIVERS, DISPLAYS, AND DUPLEXERS:** The Radar Receiver, Noise Figure, Mixer, Low-Noise Front-Ends, Displays, Duplexers and Receiver Protectors. **DETECTION OF RADAR SIGNALS IN NOISE:** Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise. **15 Hours**	**CO5**

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Develop** the Radar range equation and **Solve** analytical problem.
CO2	**Explain** the working of CW & FMCW Radar and its applications.
CO3	**Describe** the working of MTI and Pulse Doppler Radar and its performance.
CO4	**Discuss** the concept of tracking and different tracking techniques.
CO5	**Analyze** the characteristics of matched filter receiver performance and **Evaluate** the various components of radar receivers and their displays.

Learning Resources

Text books:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.

Reference books:

1. Introduction to Radar Systems, 3rd Edition – M.I. Skolnik, TMH Ed., 2005
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.

IV Year-I SEMESTER

L	T	P	C
3	0	0	3

OPTICAL COMMUNICATIONS
Professional Elective-IV

Pre-Requisites: Analog Communications and Digital Communications, Basics related to RF field Analysis

Course Objectives:

1. To analyze the reliability of fiber optic communications
2. To understand the characteristics and construction of optical fiber cable.
3. To develop the knowledge of Fiber splicing and optical sources
4. To identify and understand the operation of various optical detectors and receiver operation.
5. To Understand the optical system design and WDM

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to optical fiber communication** - Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays. **Types of Fibers:** Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems. **11 hrs**	**CO1**
II	**Signal Distortion in Optical Fibers:** Attenuation, Absorption, Scattering and Bending Losses, Core and Cladding Losses, Information Capacity Determination, Group Delay, Types of Dispersion - Material Dispersion, Wave-Guide Dispersion, Polarization Mode Dispersion, Intermodal Dispersion, Pulse Broadening. **09 hrs**	**CO2**
III	**Optical Fiber Connectors & Splicing:** Connector Types, Single Mode Fiber Connectors, Connector Return Loss Splicing Techniques, Splicing Single Mode Fibers, Fiber Alignment and Joint Loss- Multimode Fiber Joints, Single Mode Fiber Joints. **Optical Sources**- LEDs, Structures, Materials, Quantum Efficiency, Power, Modulation, Power Bandwidth Product, Injection Laser Diodes- Modes, Threshold Conditions, External Quantum Efficiency, Laser Diode Rate Equations, Resonant Frequencies, Reliability of LED & ILD. **18 hrs**	**CO3**

IV	**Optical Detectors -** Physical Principles of PIN and APD, Detector Response Time, Temperature Effect on Avalanche Gain, Comparison of Photo Detectors, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources**.** **10 hrs**	**CO4**
V	**Optical system design**- Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern. **12 hrs**	**CO5**

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand and analyze the constructional parameters of optical fibers
CO2	Estimate the losses due to attenuation, absorption, scattering and bending
CO3	Be able to Understand the concept of fiber splicing and optical sources
CO4	Compare various optical detectors and choose suitable one for different applications.
CO5	Understand the design of optical system and WDM concepts

Learning Resources

Text books:

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.
3. Photonic Crystal Fibers- Proceedings of the International School of Semiconducting Compounds, Jaszowiec 2004.

Reference books:

1. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
2. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.
3. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
4. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.

E-Resources & other digital material:

NPTEL Lecture material

1. Lecture Series on Optical Fiber Communications by Prof. Deepa Venkatesh, Department of Electrical Engineering, IIT Madras. https://nptel.ac.in/courses/108/106/108106167/

IV Year-I SEMESTER

L	T	P	C
3	0	0	3

DIGITAL IMAGE PROCESSING
Professional Elective -V

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. Understand the need for compression and familiarize few compression methods

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS** Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing. Introduction, 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.	**CO1**
II	**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.	**CO2**
III	**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, image reconstruction from projections.	**CO3**
IV	**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.	**CO4**
V	**IMAGE COMPRESSION** Introduction, Need for image compression, Redundancy in images, Classification	**CO5**

	of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard. **Content beyond Syllabus** Basic concepts of Pattern Recognition and examples of Pattern Recognition (Finger Print Recognition, etc.) Systems, Linear Decision Functions with examples illustrating various cases, concept of pattern space and weight space.	

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
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** the performance of different image compression techniques. **{Analyzing level, KL4}**

Learning Resources

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

L	T	P	C
3	0	0	3

ARTIFICIAL NEURAL NETWORKS
Open Elective-II

Pre-Requisites: Higher Engineering Mathematics e.g. linear algebra, multivariate calculus and Probability theory, Fundamental knowledge of signals and systems along with types, Mathematical representation of signals and system modelling in time as well as frequency domain

Course Objectives:

1. To introduce the concept of artificial neuron models.
2. To study various neural network architectures and learning strategies.
3. To study Dynamics in Neural networks Models.
4. To identify the different structures of artificial neural networks.
5. To know some application of artificial neural networks

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to ANN: (12hrs)** Features, structure and working of Biological Neural Network, Trends in Computing Comparison of BNN and ANN **Basics of Artificial Neural Networks** History of neural network research, characteristics of neural networks, terminology, models of neuron Mc Culloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture.	**CO1**
II	**Backpropagation networks: (BPN): (12hrs)** Architecture of feed forward network, single layer ANN, multilayer perceptron model, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuningparameters in BPN, Numbers of hidden nodes, learning.	**CO2**
III	**Activation and Synaptic dynamics: (12hrs)** Introduction, Activation Dynamic models, (Issues in the development of Activation Dynamic models, Additive Dynamic model, shunting Activation model, Stochastic models), Synaptic Dynamics models (Learning, Requirements of Learning laws, categories of learning), Distinction between Activation and Synaptic Dynamics models, Stability and Convergence, recall in neural networks.	**CO3**
IV	**Feedforward Neural Networks: (14hrs)** Linear responsibility X-OR problem and Solution. Analysis of pattern mapping networks summary of basic gradient search methods. **Feedback neural networks:** Pattern Storage networks, stochastic networks, simulated Annealing, Boltzmann machine, and Boltzmann learning.	**CO4**
V	**Applications of Neural Networks: (12hrs)** Introduction to Competitive learning in Neural Networks, CNN and RNN Transfer learning, Applications of neural networks in speech processing, Applications of Neural Networks in image processing.	**CO5**

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the concept of Artificial Neuron**.**
CO2	Know various ANN architectures and learning strategies.
CO3	Understand Dynamics in Neural Networks Models.
CO4	Understand different structures of Artificial Neural Networks.
CO5	Understand Some application of Artificial Neural Networks

Learning Resources

Text books:

1. B. Yegnanarayana - Artificial neural network PHI Publication.
2. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S.Rajasekaran and G.A. Vijayalakshmi Pai – PHI Publication.
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005

4. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,1995 Nelson Morgan – Artificial neural network: Electronic Implementations – IEEE Press, 1990

Reference books:

1. Introduction to Artificial Neural Systems – Jacek M. Zurada, Jaico Publishing House, 1997.
2. Fundamentals of Neural Networks Architectures, Algorithms and Applications - by laurene Fausett, Pearson.
3. Neural Networks, Algorithms, Applications and programming Techniques by James A. Freeman, David M. Skapura.
4. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam, S Sumathi, S
5. N Deepa TMGH

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

L	T	P	C
0	0	3	1.5

MICROWAVE ENGINEERING & OPTICAL COMMUNICATION LABORATORY

LIST OF EXPERIMENTS:

Minimum Ten Experiments to be conducted:

PART-A

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

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

IV Year-II SEMESTER

L	T	P	C
3	0	0	3

SATELLITE COMMUNICATIONS
Professional Elective VI

Pre-Requisites: Analog & Digital Communications, Antennas and 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.

Syllabus

Unit No	Contents	Mapped CO
I	**INTRODUCTION:** Origin of Satellite Communications, Historical Background, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications. **ORBITAL MECHANICS AND LAUNCHERS:** Orbital Mechanics, Look Angle determination, Orbital Perturbations, Orbit determination, Launches and Launch vehicles, Orbital Effects in Communication Systems Performance. **14 Hours**	**CO1**
II	**SATELLITE SUBSYSTEMS:** Attitude and Orbit Control System, Telemetry, Tracking, Command and Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification. **10 Hours**	**CO2**
III	**SATELLITE LINK DESIGN:** Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design of Satellite Links for Specified C/N, System Design Examples. **SATELLITE ACCESS:** Analog – Digital Transmission System- Modulation and Multiplexing, Digital Video Broadcast, Types of Multiple Access: FDMA Concepts - Inter Modulation and Back Off - SPADE System, TDMA Concepts - Frame and Burst Structure, CDMA Concepts, Comparison of Multiple Access Schemes. **15 Hours**	**CO3**
IV	**EARTH STATION TECHNOLOGY:** Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods. **EARTH SEGMENT:** Receive Only Home TV Systems – Outdoor Unit – Indoor Unit for Analog (FM) TV, Master Antenna TV System, Community Antenna TV System, Transmit – Receive Earth Stations. **12 Hours**	**CO4**
V	**SATELLITE APPLICATIONS:** INTELSAT Series, INSAT, VSAT, Mobile Satellite Services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast Satellites (DBS) - Direct to Home Broadcast (DTH), Digital Audio Broadcast (DAB) - World Space Services, Business TV (BTV), GRAMSAT, Specialized Services – E mail, Video Conferencing, Internet. **13 Hours**	**CO5**

Course Outcomes:

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

Learning Resources

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.

E-Resources & other digital material:

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-II SEMESTER

L	T	P	C
3	0	0	3

ENVIRONMENTAL POLLUTION AND ITS CONTROL
Open Elective III

Course Objectives:

1. To introduce the concepts of Air Pollution.
2. To introduce the concepts of Air Pollution and its control methods.
3. To impart the knowledge of the Solid Waste generation problem.
4. To familiarize the best practices for management of solid wastes adopted at the service provider level.
5. To elucidate noise pollution problems and emphasize the necessity to control them.

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Air Pollution** Definitions, scope, significance and episodes – Types of pollutants, their sources and impacts (on plants, animals, materials) – Classifications, natural & artificial, primary & secondary, point &non point, linear & areal sources, stationary & mobile – Sampling and analysis of air pollutants – Ambient air quality standards by WHO (World Health Organization) & CPCB (Central Pollution Control Board). **Air Pollution Meteorology** Properties of atmosphere: heat, pressure, wind forces, moisture and relative humidity – Lapse rates – Influence of terrain and meteorological phenomena on plume behavior and air quality – Wind rose diagrams, plume rise models.	**CO1**
II	**Air Pollution Control and Monitoring** Control of particulates: control at sources, process changes, equipment modifications – Design and operation of control equipments, settling chambers, cyclone separators, fabric filters, scrubbers, electrostatic precipitators – Control of gases like SOx , NOx , CO and HC, Air-fuel ratio, computation and control of products of combustion – Monitoring of SPM, SO2 , NOx and CO, Stack Monitoring for flue gases	**CO2**
III	**Solid Waste Generation and Collection** Characteristics – types, sources, and properties of solid waste – Generation, typical generation rates, estimation of solid waste quantities, factors that affect generation of wastes – Collection services, types of collection systems, determination of vehicle and labour requirement and transportation of solid waste – Transfer stations, transfer means and methods.	**CO3**
IV	**Solid Waste Management and Disposal** Engineered systems for solid waste management (refuse, reduce, reuse, recover, recycle) – Reuse of solid waste materials, processing techniques, materials recovery system, recovery of biological, thermal conversion products and recovery of energy from conversion products – Recycling of segregated waste materials – Ultimate Disposal of solid waste (Land filling, incineration, composting).	**CO4**
V	**Noise Pollution and Control** Sources of noise pollution, impacts of noise, measurement of noise and	**CO5**

	permissible limits of noise, control methods of noise pollution, The Noise Pollution (Regulation and Control) Rules, 2000 as per CPCB.	

Course Outcomes:

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Evaluate the ambient air quality based on the analysis of air pollutants and relate the polluting plume behavior with weather data.
CO2	Identify suitable control methods depending on the severity and type of air pollution.
CO3	Classify solid wastes and identify suitable collection and transfer mechanisms.
CO4	Suggest suitable solid waste management methods based on the nature of solid waste and the quantities to be handled.
CO5	Identify the sources of noise pollution and suggest methods for mitigating the problem.

Learning Resources

Text books:

1. Air Pollution, M.N.Rao, H.V.N.Rao, 1st Edition, McGraw Hill Education.
2. Solid and Hazardous Waste Management, M.N.Rao, Razia Sultana, 1st Edition, BS Publications.
3. Noise Pollution and Its Control,H.C.Bhatia, 1st Edition, Atlantic Publisher

Reference books:

1. Advanced Air and Noise Pollution Control, Lawrence K.Wang, Norman C. Pereira, Yung-Tss Hung, 2005 Edition, Humana Press.
2. Municipal Solid Waste Management, P.Jayarama Reddy, 1st Edition, B.S.Publications.

E-Resources & other digital material:

1. Environmental Pollution and Control, 4th ed. by J. Jeffrey Peirce, P. Aarne Vesilind, Ruth F. Weiner
   https://www.bbau.ac.in/dept/UIET/TCE-033%20%20epdf.pub_environmental-pollution-and-control.pdf

2. ENVIRONMENTAL POLLUTION - CONTROL MEASURES
   https://www.bbau.ac.in/dept/UIET/Study%20Materials%20for%20TCE-0.pdf

IV Year-II SEMESTER

L	T	P	C
3	0	0	3

ENTREPRENEURIAL SKILL DEVELOPMENT
Open Elective IV

Pre-Requisites: Basic Sciences and Humanities.

Course Objectives:

1. To impart the basic knowledge of entrepreneurship skills for better understanding of entrepreneurial scenario.
2. To understand the knowledge of theories of entrepreneurship and to motivate students to become entrepreneur.
3. To identify opportunities in starting own ventures.
4. To understand and plan business model for a start up.
5. To analyze the role of government and non government institutions in supporting entrepreneurial activities.

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Unit 1** **Foundation of Entrepreneurship** **10 hrs** Concept and Need of Entrepreneurship, Characteristics and types of Entrepreneurship, 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.	**CO1**
II	**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.	**CO2**
III	**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**.**	**CO3**
IV	**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.	**CO4**
V	**Unit 5** **Entrepreneurial Development and Government** **10 Hrs** Role of Central Government and State Government in promoting entrepreneurship with various incentives, subsidies, grants, programmed	**CO5**

	schemes and challenges, Government initiatives and inclusive entrepreneurial growth**.**	

Course Outcomes:

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 scenario are understood
CO2	Apply Knowledge of theories of entrepreneurship and to identify entrepreneurial opportunities for women
CO3	Identify opportunities supporting entrepreneurship
CO4	Analyze the milestones and related challenges in developing new venture
CO5	Understand government role supporting entrepreneurship

Learning Resources

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 your startup, 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, Himalaya Publishing House, 2015.
4. AnajanRai Chaudhuri, Managing new ventures, concepts and cases, Prentice Hall International, 2010.
5. Rajeev Roy: Entrepreneurship, Oxford university press, New Delhi, 2010

E-Resources & other digital material:

1. https://nptel.ac.in/courses/110105067/50
2. http://www.yourarticlelibrary.com/project-management/5-methods-of-project-appraisalexplained/40771
3. https://springhouse.in/government-schemes-every-entrepreneur/
4. http://nptel.ac.in/courses

5. https://www.tutorialspoint.com/
6. https://www.ediindia.org/
7. http://www.quickmba.com/entre/