DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

(4-Year B.Tech Program)

WITH EFFECT FROM 2015-16 ADMITTED BATCH

Academic Regulations
Curriculum & Syllabi

PRAGNANAM BRAHMA
ANITS

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES
(UGC AUTONOMOUS)
(Affiliated to AU, Approved by AICTE & Accredited by NBA & NAAC with 'A' Grade)
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ANIL NEERUKONDA
INSTITUTE OF TECHNOLOGY AND SCIENCES
(AUTONOMOUS)

Affiliated to Andhra University

Academic Regulations
Curriculum &
Syllabi

ACCREDITED BY NBA & NAAC WITH 'A'GRADE

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES

(AUTONOMOUS)

VISION

ANITS envisions to emerge as a world-class technical institution whose products represent a good blend of technological excellence and the best of human values.

MISSION

To train young men and women into competent and confident engineers with excellent communicational skills, to face the challenges of future technology changes, by imparting holistic technical education using the best of infrastructure, outstanding technical and teaching expertise and an exemplary work culture, besides moulding them into good citizens.

QUALITY POLICY

ANITS is engaged in imparting quality technical education. It constantly strives towards achieving high standards of teaching, training and development of human resources by encouraging its faculty and staff to work as a team and to update their knowledge and skills continually to match the needs of industry.

Foreword

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES (ANITS) was founded by Anil Neerukonda Educational Society (ANES) in the fond memory of Anil Neerukonda, son of Dr. B R Prasad Neerukonda.

Its humble journey started in 2001 with an intake of 220 students into four undergraduate B.Tech programmes. Within 14 years of its establishment, the institute registered phenomenal growth and is accredited by NAAC with „A" and by NBA for the third time. It is permanently affiliated to Andhra University and has achieved autonomous status in 2015. Further, the institute has been currently ranked as 4th among the private engineering colleges in Andhra Pradesh by APSCHE. It has been recognised as "Centre for Excellence" by Infosys and is accorded by Andhra University as "Centre for Research".

Today, the institute offers seven B.Tech. programmes and four M.Tech. programmes with an annual total intake about 1100 students. The institute offers amenities like separate hostels for boys and girls, indoor and outdoor games, transport covering all the major locations of Visakhapatnam and medical aid provided by Anil Neerukonda hospital and NRI Institute of Medical Sciences, another educational institution of ANES.

Apart from the State-of-the-Art laboratories, well established teaching methodology and implementation of the best practices, the wonderful co-ordination of the Management, Faculty and Parents has so far played a crucial role in shaping the future of the ANITIANS and has been the talisman of the Institute"s phenomenal growth.

The success stories of our champions at several qualifying exams for the higher studies like GRE, TOEFL, CAT and GATE, the impressive track record of the placements with highest known packages in MNCs like Google, Oracle, Infosys, TCS and so on are the sweetest fruits of our efforts.

PRAGNANAM BRAHMA, the motto of ANITS, is truly practiced by all the members of ANITS family, a direct effort to serve the society, nation and the mankind as well.

Hearty welcome to ANITS family.

Prof. V S R K PRASAD
PRINCIPAL

Achievements & Highlights

- Extension of permanent affiliation by Andhra University
- Autonomous since May 2015
- Accredited by NAAC with „A‟ Grade
- NBA accreditation to ECE,EEE,CSE, Mech and IT courses
- Recognition as “Research Center” and award of “Permanent Affiliation” by Andhra University
- Recognition under 2(f) & 12(b) of the UGC act
- Secured 3rd place in TOP Engineering Colleges in Andhra Pradesh, survey by CSR-GHRDC 2017
- Secured 20th place in ranking of outstanding Engineering College of excellence by CSR-GHRDC 2017
- Securing highest pass percentage among all the private affiliated colleges of the university
- Good number of placements in reputed organizations
- Students won various contents organized by reputed companies like TCS, Infosys (CODE VITA, ASPIRATIONS, ACM ICPC-2014 etc) and brought laurels to the institute
- Student won several prizes in various extracurricular competitions, cultural and sports competitions at university, state and national levels.
- Quality publications by the faculty in journals of repute with impact factor
- ANITS has been recognized as Skill Development Center (SDC) under AP state skills development corporation (APSSDC)(A state government organization)
- TOP- ten most Preferred college out of 700+ Private Engineering colleges in the state of erstwhile AP(APSCHE bulletin)
- „AAA‟ rating of ANITS by career 360 Magazine (MAY 2013)
- Award of „Center of Excellence by Infosys Technologies Ltd during 2010-11
- MOUS with about 18 organizations and accreditation by TCS, Infosys, Capgemini India(HYD), Silver partner of Keane India L&T (ECC) , Tech-Mahindra, Hyundai, BGR Energy, FMC Technologies, etc for campus Recruitment.
- Students secured TOP positions at national level in CODE-VITA contest organized by TCS and national champions in ASPIRATIONS organized by Infosys competing with IITs , NITs and other Premium Engineering colleges across the nation and emerged as winners.
- Students team represented India as one of the 7 teams in the contest ACM ICPC (Asian Programming Contest) and participated in the final round Ekaterinburg, Ural Federal University, Russia during June 2014.
- CSI Student Branch bagged „Best Student Branch Award‟ consecutively for 3 years (2011-2014) in the entire AP and Karnataka region(Region-V)
- In house development of software for student feedback, Result analysis, Attendance, website design etc.
- Mr.Anudeep, former student of CSE branch (2010-14) secured a job in Google with a pay package of 1.44 crores+ perks.

Contents

DEPARTMENT OF ELECTRONICS & COMMUNICATIONENGINEERING

VISION

To become a centre of excellence in Education and Research and produce high quality engineers in the field of Electronics and Communication Engineering to face the challenges of future technology changes.

MISSION

To achieve vision department will

- *Transform students into valuable resources for industry and society by imparting contemporary technical education.*
- *Develop interpersonal skills and leadership qualities among students by creating an ambience of academic integrity to participate in various professional activities*
- *Create a suitable academic environment to promote research attitude among students.*

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: *Graduates excel in their career in the domains of Electronics, Communication and Information Technology*

PEO2: *Graduates will practice professional ethics and excel in professional career through interpersonal skills and leadership qualities*

PEO3: *Graduates demonstrate passion for competence in higher education, research and participate in various professional activities*

PROGRAM OUTCOMES (POs)

PO-1 ***Engineering knowledge:*** *Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.*

PO-2 ***Problem analysis:*** *Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.*

PO-3 ***Design/development of solutions:*** *Design solutions for complex engineering problems and design system components or processes that meet the specified needs.*

PO-4 ***Conduct investigations of complex problems:*** *An ability to design and conduct scientific and engineering experiments, as well as to analyze and interpret data to provide valid conclusions*

PO-5 ***Modern tool usage:*** *Ability to apply appropriate techniques, modern engineering and IT tools, to engineering problems.*

PO-6 ***The engineer and society:*** *An ability to apply reasoning to assess societal, safety, health and cultural issues and the consequent responsibilities relevant to the professional engineering practice*

PO-7 ***Environment and sustainability:*** *An ability to understand the impact of professional engineering solutions in societal and environmental contexts*

PO-8 ***Ethics:*** *Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.*

PO-9 ***Individual and team work:*** *Ability to function effectively as an individual, and as a member or leader in a team, and in multidisciplinary tasks.*

PO-10 ***Communication:*** *Ability to communicate effectively on engineering activities with the engineering community such as, being able to comprehend and write effective reports and design documentation, make effective presentations.*

PO-11 ***Project management and finance:*** *An ability to apply knowledge, skills, tools, and techniques to project activities to meet the project requirements with the aim of managing project resources properly and achieving the project's objectives.*

PO-12 ***Life-long learning:*** *Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.*

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Implement Signal & Image Processing techniques using modern tools.

PSO2: Design and analyze Communication systems using emerging techniques.

PSO3: Solve real time problems with expertise in Embedded Systems.

ACADEMIC REGULATIONS

ACADEMIC REGULATIONS FOR B.TECH PROGRAMME
UNDER AUTONOMOUS STATUS
W.E.F. THE ADMITTED BATCH OF 2015-16

I. Admissions:

Admissions into first year of B.Tech. Programme and admissions into second year (lateral entry) of B.Tech. Programme of the Institute will be as per the norms stipulated by Andhra University & Andhra Pradesh State Council for Higher Education (APSCHE), Govt. of Andhra Pradesh. The academic regulations of Autonomous status mentioned herewith will be applicable from 2016-17 in case of Lateral Entry admissions.

II. Programmes Offered:

The following are the B.Tech. Programmes offered by the Institute.

1 Chemical Engineering
2 Civil Engineering
3 Computer Science & Engineering
4 Electrical & Electronics Engineering
5 Electronics & Communication Engineering
6 Information Technology
7 Mechanical Engineering

III. Structure of the B. Tech. Programme:

The programme of instruction will consist of Humanities, Basic Sciences, Engineering Sciences and Technology. The complete programme is distributed over eight semesters with two semesters per academic year. Every branch of B.Tech programme will have a curriculum and syllabi for the courses recommended by the Board of Studies and approved by the Academic Council. The academic programmes of the Institute follow the credit system. The curriculum of B.Tech programme is designed to have a total of about 189 credits of which a student should acquire a minimum of 180 credits to get the degree awarded. If a student earns all the total credits, then the best 180 credits are

considered to determine the final CGPA. The lateral entrants shall have a total of about 146 credits of which one should acquire a minimum of 137 credits to get the degree awarded. If a student takes all the credits, then the best 137 credits are considered to determine the final CGPA. However, the credits which a student can forego will be in accordance with the mandatory courses and electives offered by the individual departments.

IV. Duration of the Programme:

The duration of the programme is four academic years consisting of two semesters in each academic year. A student is permitted to complete the programme in a stipulated time frame of 8 consecutive academic years from the date of initial admission. Students joining the programme in the 2nd year through lateral entry scheme shall have to complete the programme in a stipulated time frame of 6 consecutive academic years from the date of initial admission.

V. Medium of Instruction:

The medium of instruction and examination is English.

VI. Minimum Instruction Days:

Each semester normally consists of a minimum of 16 weeks of instruction.

VII. Academic Calendar:

The dates of all important events, such as commencement of class work, examinations, vacations, etc., during the academic year will be specified in the Academic Calendar of the Institute, as approved by the Academic Council.

VIII. Examinations & Evaluation Process:

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks each for theory and practical/drawing subjects.

(A) Theory Course:

For all lecture based theory courses, the assessment shall be for 40 marks through internal evaluation and 60 marks through external semester-end examination of three hours duration except for the subjects with 100% internal assessment in which case an internal examination will be conducted for 60 marks along with the semester-end examinations.

i) Internal evaluation:

The sessional marks shall be awarded through internal evaluation by the teachers concerned based on the continuous assessment which includes class tests, quiz, viva-voce, assignments, student regularity, two mid-examinations etc., according to a scheme notified by the department at the beginning of the semester.

Out of the 40 internal evaluation marks, 20 marks are assigned for 2 internal-mid exams, 10 marks for assignments, 5 marks for projects/ case studies /quiz/tests and 5 marks for attendance. The average of 2 internal-mid exams is considered for the 20 marks allocated.

Under any circumstances, no re-examination shall be conducted for the internal mid examinations.

ii) External evaluation:

The question paper shall be set externally and the answer scripts are valued through a double valuation system.

The average of the two valuations will be taken for the award of marks. In case, the difference of the marks obtained in the two valuations is more than 20%, then a third examiner shall value the script. Out of the three valuations, the average of marks obtained in third valuation and the marks obtained nearer to third valuation out of first two valuations shall be considered. No revaluation for any subject/course shall be entertained as already double valuation system is in existence. However, recounting is allowed on the request of the candidate on payment of specified fee. Challenge valuation shall also be entertained on payment of specified fee.

(B) Laboratory Course:

Each student will perform about 10 to 12 experiments in each laboratory course. Laboratory course will be evaluated for 100 marks, out of which 50 marks are for external examination and 50 marks are for internal evaluation. The internal marks are awarded based on continuous assessment, record work, internal lab examination and student regularity. The external examination will be conducted by two examiners, one of them being laboratory class teacher as internal examiner (nominated by the Principal on recommendation of HOD) and an external examiner nominated by the Principal from the panel of experts recommended by the HOD.

A candidate shall be declared to have passed any theory subject/course if he secures not less than 40% in external theory examination and also a minimum of 40% of total marks of that course which assures a minimum of 'E' grade.

A candidate shall be declared to have passed any practical course if he secures not less than 50% in external laboratory examination and also a minimum of 50% of total marks of that course which assures a minimum of 'D' grade.

Only in the case of quantitative and verbal aptitude – I & II, if a candidate fails he is given an opportunity to improve to pass grade (E) irrespective of the score he gets over and above pass mark in the reexamination within one month on payment of special examination fee.

Any student appearing for the semester-end practical examination is eligible only if he submits the bonafide record certified by the laboratory class teacher and the HOD.

(C) Project Work:

The project work is evaluated for 300 marks out of which 100 through internal assessment in the IV Year I semester through continuous assessment followed by final evaluation by a committee nominated by the HOD. For the 200 marks in IV year II semester, assessment is done for 100 marks internally and for the remaining 100 marks by the committee consisting of at least one external expert nominated by the Principal.

If a student fails in the fourth year first semester project he has to appear for reassessment within one month for which he has to pay the reexamination fee.

(D) Industrial Training:

The industrial training is assessed internally for 100 marks by an internal evaluation committee constituted by the HOD.

(E) Supplementary Exam:

There will be supplementary examination for the programme such that for odd semester courses the supplementary exams will be conducted during summer vacation and for the even semester courses, the supplementary exams will be conducted during the winter vacation.

IX. Attendance Regulations:

Attendance of a student is computed by considering total number of periods conducted in all courses as the denominator and the total number of periods actually attended by the student in all courses, as the numerator. It is desirable for a student to put in 100% attendance in all the subjects. However, a candidate shall be permitted to appear for the semester end examination provided he maintains a minimum of 75% overall attendance in the semester.

The shortage of attendance on medical grounds can be condoned up to a maximum of 9% provided the student puts in at least 66% attendance and provided the Principal is satisfied with the genuineness of the reasons. The Medical Certificates are to be submitted to the Head of the Department when the candidate reports to the classes immediately after the absence. Certificates submitted afterwards shall not be entertained. Condonation fee as fixed by the college for those who put in attendance between $\geq$ 66% and <75% shall be charged before the semester-end examinations.

In the case of students who participate in co-curricular, extra-curricular activities like student seminars, N.S.S, N.C.C, Inter-collegiate tournaments and any such other activities involving the representation of the Institute, with the prior approval of the

Principal, the candidate may be deemed to have attended the classes during the actual period of such activity, solely for the purpose of attendance.

A student, who could not satisfy the minimum attendance requirement of 66% in any semester, shall be declared „Detained". He is not eligible to appear for the semester end examinations. He will not be promoted to the next semester and shall have to repeat that semester with the next batch(es) of students. Such students who are detained and seek readmission, should submit an undertaking/a declaration that they will abide by the regulations existing at the time of readmission.

X. Minimum Academic Requirements:

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

- A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory subject if only he secures not less than 40% marks in the semester-end examination and a minimum of 40% marks in the sum of the internal evaluation and semester-end examination taken together. In the labs/projects, the student should secure a minimum of 50% marks in the external examination and a minimum of 50% marks in the sum of internal evaluation and external examination evaluation taken together.

- A student will be promoted to the next semester, if only he satisfies the minimum attendance requirement.
- A student shall be promoted from II Year to III Year only if he fulfills the academic requirement of total 50 % of all credits from regular and supplementary examinations of I Year and II Year – I Semester { i.e., total 3 semesters} examinations, irrespective of whether the candidate takes the examination in all the subjects or not.
- A student shall be promoted from III Year to IV Year only if he fulfills the academic requirements of total 50% of credits from regular and supplementary examinations of I Year, II Year and III Year- I Semester {i.e., total 5 semesters}, irrespective of whether the candidate takes the examinations in all the subjects or not.

- For lateral entry students, there is no credit based restriction for promotion from II year to III year. But a lateral entry student shall be promoted from III year to IV year only if he fulfills the academic requirements of total 50% of credits from regular and supplementary examinations of II year and III year- I Semester {i.e., total 3 semesters} irrespective of whether the candidate takes the examinations in all the subjects or not.

- Students, who fail to complete their B.Tech. Programme within eight academic years from the year of their admission or fail to acquire the credits stipulated for the programme shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled. For lateral entry students they have to complete the programme in six years from their year of admission.

XI. Award of Grades:

The absolute grading system is adopted as follows:

S.No.	Range of Marks {%}	Grade	Description	Grade Points
1	90-100	O	Outstanding	10
2	80-89	A	Excellent	9
3	70-79	B	Very Good	8
4	60-69	C	Good	7
5	50-59	D	Fair	6
6	40-49	E	Satisfactory	5
7	39 and below.	F	Fail	0
8	The grade „I‟ represents absent (subsequently changed into pass or higher grades.)	I	Absent	0

Note: Minimum grade to pass in a laboratory course is 'D'.

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

$$SGPA = \frac{\Sigma \text{ (Credits of a course x Grade points awarded for a course)}}{\Sigma \text{ (Credits of a course)}}$$

SGPA is calculated for the candidates who have passed in all the courses in that semester.

Cumulative Grade Point Average (CGPA) will be calculated from II semester onwards up to the final semester and its calculation is similar to that of SGPA, considering all the courses offered from the first semester onwards.

CGPA is calculated for those who clear all the courses in all the previous semesters.

XII. Award of Class:

For award of class, a total of best 180 credits are considered in case of four year programme and best 137 credits in case of lateral entry admitted students. A candidate, who becomes eligible for the award of B.Tech.Degree, shall be placed in one of the following classes.

S.No.	Class	CGPA
1	First Class with Distinction	7.5 or more*
2	First Class	6.5 or more but less than 7.5
3	Second Class/Pass	5.0 or more but less than 6.5

***First class with Distinction will be awarded only to those students who clear all the subjects of the program in first attempt of regular examinations.**

The CGPA can be converted to aggregate percentage by multiplying CGPA with 10, in case of requirement by any other university or for any other purpose.

XIII. Eligibility for Award of B.Tech. Degree:

A student shall be eligible for the award of the B.Tech degree if he fulfills all the following conditions:

1) Registered and successfully completed all the components prescribed for eligibility in the Programme of study to which he/she is admitted within the stipulated period,
2) Obtained CGPA greater than or equal to 5.0 (Minimum requirement for Pass),
3) No disciplinary action is pending against him/her and
4) Has no dues to the Institute including hostels.

XIV. Malpractices:

The Controller of Examinations/Dean of Examinations shall refer the cases of suspected malpractices in mid examinations and semester-end examinations to Malpractice Enquiry Committee constituted by the Institute. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action against the erring students based on the recommendations of the committee.

XV. Amendments To Regulations:

The Institute may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabi and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

XVI. General:

(i) Where the words 'he', 'him', 'his', occur in the regulations, they include 'she', 'her', 'hers'.

(ii) The academic regulation should be read as a whole for the purpose of any interpretation.

(iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

CURRICULUM

Course Structure - B.Tech 4 Year Degree Course

First Year I - Semester

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE111	English	HS	3	1	-	4	40	60	3
ECE112	Engineering Mathematics I	BS	3	1	-	4	40	60	3
ECE113	Engineering Chemistry	BS	3	1	-	4	40	60	3
ECE114	Professional Ethics & Human Values	HS	2	1	-	3	100	-	2
ECE115	Engineering Physics	BS	3	1	-	4	40	60	3
ECE116	Engineering Chemistry lab	BS	-	-	3	3	50	50	2
ECE117	Programming with C Lab	ES	2	-	3	5	50	50	3
ECEAC1	NCC/ NSS/ Sports	AC	-	-	3	3	-	-	-
Total			16	5	9	30	360	340	19

First Year II - Semester

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE121	Engineering Mathematics II	BS	3	1	-	4	40	60	3
ECE122	Applied Physics	BS	3	1	-	4	40	60	3
ECE123	Environmental Science	BS	3	1	-	4	40	60	3
ECE124	Engineering Drawing	ES	1	-	3	4	40	60	3
ECE125	Basic Electronics Engineering	ES	3	1	-	4	40	60	3
ECE126	Engineering Physics lab	BS	-	-	3	3	50	50	2
ECE127	Language Lab	HS	-	-	3	3	50	50	2
ECE128	Object Oriented Programming with C++ Lab	ES	2	-	3	5	50	50	3
ECE129	Workshop	ES	-	-	3	3	50	50	2
ECEAC 2	NCC/ NSS/ Sports	AC	-	-	3	3	-	-	-
Total			15	4	18	37	400	500	24

Second Year I - Semester

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE211	Engineering Mathematics-III	BS	3	1	-	4	40	60	3
ECE212	Electrical Machines	ES	3	1	-	4	40	60	3
ECE213	Data structures	ES	3	1	-	4	40	60	3
ECE214	Signals and Systems	PC	3	1	-	4	40	60	3
ECE215	Network analysis and synthesis	ES	3	1	-	4	40	60	3
ECE216	Electronic Circuits and Analysis-I	PC	4	1	-	5	40	60	4
ECE217	Electronic Circuits and Analysis-I Laboratory	PC	-	-	3	3	50	50	2
ECE218	Network & Electrical Machines Laboratory	ES	-	-	3	3	50	50	2
Total			19	6	6	31	340	460	23

Second Year II - Semester

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE221	Engineering Mathematics –IV	BS	3	1	-	4	40	60	3
ECE222	Electronic Circuits and Analysis-II	PC	3	1	-	4	40	60	3
ECE223	Digital Electronics	PC	3	1	-	4	40	60	3
ECE224	Probability Theory & Random Processes	PC	3	1	-	4	40	60	3
ECE225	Electromagnetic Field Theory & Transmission Lines	PC	3	1	-	4	40	60	3
ECE226	Control Systems	ES	3	1	-	4	40	60	3
ECE227	Electronic Circuits and Analysis-II Laboratory	PC	-	-	3	3	50	50	2
ECE228	Simulation Laboratory	PC	-	-	3	3	50	50	2
	Massive Open Online Course (MOOC)	AC	-	-	-	-	-	-	-
Total			18	6	6	30	340	460	22

Third Year I–Semester

Code	Subject name	Instruction periods per Week					Max Marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE 311	Open Elective- I	OE	3	1	-	4	40	60	3
ECE 312	Communication Systems Engineering	PC	4	1	-	5	40	60	4
ECE 313	Microprocessors and Applications	PC	3	1	-	4	40	60	3
ECE 314	Computer Architecture & Organization	ES	3	1	-	4	40	60	3
ECE 315	Integrated circuits and Applications	PC	3	1	-	4	40	60	3
ECE 316	Antennas & Wave Propagation	PC	3	1	-	4	40	60	3
ECE 317	Microprocessors & Applications Laboratory	PC	-	-	3	3	50	50	2
ECE 318	IC Laboratory	PC	-	-	3	3	50	50	2
ECE 319	Quantitative Aptitude & Verbal Aptitude-I	HS	4	-	-	4	100	-	2
Total			23	6	6	35	440	460	25

Open Elective- I: (for ECE, offered by other departments) Refer Annexure-I

Third Year II–Semester

Code	Subject name	Instruction periods per Week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE 321	Microwave & Radar Engineering	PC	3	1	-	4	40	60	3
ECE 322	Digital Signal Processing	PC	4	1	-	5	40	60	4
ECE 323	Microcontrollers & Embedded Systems	PC	3	1	-	4	40	60	3
ECE 324	Professional Elective-I	PE	3	1	-	4	40	60	3
ECE 325	Digital Communications	PC	3	1	-	4	40	60	3
ECE 326	Communication Systems Engineering Laboratory	PC	-	-	3	3	50	50	2
ECE 327	Microcontrollers & Embedded Systems Laboratory	PC	-	-	3	3	50	50	2
ECE 328	Soft Skills Laboratory	HS	-	-	3	3	100	-	2
ECE 329	Quantitative Aptitude & Verbal Aptitude-II	HS	4	-	-	4	100	-	2
Total			20	5	9	34	500	400	24

Professional Elective-I

1. Analog IC Design
2. EMI / EMC
3. Electronic Measurements and Instrumentation
4. Telecommunications and switching Networks

Industrial Training during summer vacation after Third Year II –Semester. But its grade will be accorded with the 4-1 courses of the program

Fourth Year I - Semester

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE411	Engineering Economics and Management	HS	3	1	-	4	40	60	3
ECE412	Computer Network Engineering	PC	3	1	-	4	40	60	3
ECE413	Open Elective-II	OE	3	1	-	4	40	60	3
ECE414	Professional Elective -II	PE	3	1	-	4	40	60	3
ECE415	VLSI Design	PC	3	1	-	4	40	60	3
ECE416	Elective Lab	PC	-	-	3	3	50	50	2
ECE417	Digital Communications Laboratory	PC	-	-	3	3	50	50	2
ECE418	Industrial Training Seminar	IT	-	2	2	4	100	-	4
ECE419	Project Phase – I	PW	-	-	8	8	100	-	4
Total			15	7	16	38	500	400	27

Professional Elective-II

1. Advanced Digital Signal Processing
2. Radar Signal Processing
3. Digital IC design using HDL
4. Digital Image Processing

Open Elective-II: (for ECE, offered other departments)

1. Project management
2. Industrial Safety and Hazards Management
3. IT infrastructure and management
4. Multimedia concepts 5.E-Governance
6. Robotics 7.Power Electronics

Elective Lab

1. VLSI
2. Signal and image processing
3. Virtual instrumentation
4. Antenna Design

Fourth Year II - Semester

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE421	Cellular and Mobile Communications	PC	3	1	-	4	40	60	3
ECE422	Professional Elective-III	PE	4	1	-	5	40	60	4
ECE423	Professional Elective-IV	PE	4	1	-	5	40	60	4
ECE424	Microwave Engineering Laboratory	PC	-	-	3	3	50	50	2
ECE425	Project Phase - II & Dissertation	PW	-	-	16	16	100	100	8
ECE426	Massive Open Online Course (MOOC)	OE	-	-	-	-	100	-	2
Total			11	3	19	33	270	330	23

Professional Elective-III

1. Phased array systems
2. Bio-medical Instrumentation
3. Optical communications
4. Embedded and Real Time Systems

Professional Elective-IV

1. Satellite Communications & GPS
2. VLSI Signal processing
3. Wireless sensor networks
4. Cognitive Radio Networks

COMPONENTS OF THE CURRICULUM

Course Component	Curriculum Content (% of total number of credits of the program)	Total Number of Contact Hours per week	Total Number of Credits
Basic Sciences	14.9 %	38	28
Engineering Sciences	16.5 %	44	31
Humanities and Social Sciences	8.5 %	25	16
Program Core	39.5 %	101	74
Program Elective	7.4 %	18	14
Open Elective	4.2 %	08	08
Project(s)	6.4 %	24	12
Internships/Seminars	2.1 %	04	04
Any other (NCC/ NSS/ Sports)		06	
Total Number of Credits			187

FIRST YEAR SYLLABI

I-Semester

&

II-Semester

ENGLISH

(Common for all branches)

ECE 111 **Credits:3**

Instruction : 3 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objectives:

- To improve the language proficiency of the students in English with emphasis on Reading and Writing skills.
- To enable the students to study engineering subjects with greater comprehension & cognizance.
- To strengthen the vocabulary of the students.
- To enable the students to write grammatically correct structures with logical flow.
- To equip the students with the knowledge of different formats of business communication.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyze the structure of the phrases, clauses and sentences
2.	Apply enriched vocabulary for better communication skills.
3.	Effectively use different formats of business correspondence.
4.	Use idiomatic expressions and foreign phrases in his communication.
5.	Use correct structures to write sentences.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**										**3**					
	2		**2**								**3**					
	3				**2**					**2**	**3**					
	4									**2**	**3**					
	5		**2**		**2**		**2**			**2**	**3**		**2**			

SYLLABUS

UNIT I 10 Periods

Vocabulary: One Word Substitutes

Grammar: Noun : Noun Phrase, Gerunds

Writing Skills: 1) Formal Letter writing – format, style of letter writing and types of letters --- complaint, enquiry, requesting quotations, invitation, regret and acceptance.

2) Story Building-Developing a story from the key words, giving a title and describing learning outcomes.

UNIT II 10 Periods

Vocabulary: Foreign phrases or expressions
Grammar: Adjectives: Quantifiers, qualifiers, determiners, nouns as adjectives, verbs as adjectives, adjective phrases
Writing Skills: 1.Technical Report writing – Formal reports and types: Informational reports, Analytical reports and Recommendation reports--- Status, feasibility, progress, incident and project.
2. Essay writing.

UNIT III 10 Periods

Vocabulary: Idiomatic expressions- meaning and usage.
Grammar: Articles (concept and function; definite ,indefinite and omission of articles)
Writing Skills:1. Preparation of C.V. and Resume-format, style purpose and objective.
2. Précis- writing technique with suitable title.

UNIT IV 9 Periods
Vocabulary: Phrasal Verbs derived from the following dynamic verbs: Go, Get, Run, Take, Look, Put, Hold, Stand etc.
Grammar: Prepositions or prepositional phrases
Writing Skills: 1. Reading comprehension – questions based on facts, interpretation, logical deduction, vocabulary.
2. E-mail etiquette- format, style and language

UNIT V 9 Periods
Vocabulary: Synonyms and Antonyms (From the prescribed text only)
Grammar: Pronouns: Kinds of pronouns, relative pronouns – who and whom, whose, which
Verbs - Aspects, moods, tenses, direct and indirect speech (active and passive voice), concord, Infinites and verb participles, verb phrase, Conditionals – probable, improbable, impossible, If-clause, Correction of sentences

TEXT BOOK:
Life through language Pearson Publication Delhi

REFERENCE BOOKS:
1. GJ.K. Gangal*A Practical Course for Developing Writing Skill in English*PHI
2. Mark Lester and Larry Beason *Handbook of English Grammar &Usage* Tata McGraw Hill.
3. S.M.Gupta *Current English Grammar And Usage* PHI
4. Dr. P. Prasad, Rajendra K Sharma*The Functional Aspects of Communication Skills*Katson Books
5. AbulHashem *Common errors in English* Ramesh Publishing House
6. M. Ashraf Rizvi *Effective Technical Communication* Tata Mc-Graw Hill
7. Edgar Thorpe &Showick Thorpe *Objective English* Pearson

ENGINEERING MATHEMATICS-I

(Common for all branches)

ECE 112 **Credits :3**

Instruction : 3 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objective:

- To impart knowledge in basic concepts of functions of several variables and their applications like maxima & minima.
- To enable the students to study the concepts of Fourier series.
- To enable the students to study the concepts of three dimensional figures like sphere, cone cylinder and conicoid.
- To equip the students with the knowledge of multiple integrals and their applications.
- To introduce the concepts of improper integrals like beta, gamma & error functions.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Familiarize with functions of several variables
2.	Apply Fourier series in solving boundary value problems
3.	Apply the concept of three-dimensional analytical geometry
4.	Use mathematical tools needed in evaluating multiple integral and their usage.
5.	Use the concepts of improper integrals, Gamma, Beta and Error functions which are needed in Engineering applications

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	**3**	**2**										**1**	**3**	**3**	**1**
	2	**3**	**2**										**1**	**2**	**2**	**1**
	3	**3**	**2**										**1**	**3**	**3**	**1**
	4	**3**	**2**										**1**	**3**	**3**	**1**
	5	**3**	**1**										**1**	**3**	**3**	**1**

SYLLABUS

UNIT I

Partial Differentiation: 12 Periods

Function of two or more variables – Partial Derivatives – which variable is to be treated as constant – Homogeneous functions – Euler‟s theorem – Total Derivative - Change of Variables .Jacobians – Taylor‟s theorem for functions of two variables – Maxima and Minima functions of two variables.

UNITII

Fourier series: 12 Periods

Introduction – Euler‟s formula – conditions for a Fourier expansion – Functions having points of Discontinuity – Change of interval – Even and Odd functions – Half range series-Parseval‟s formula.

UNIT III 12 Periods

Three Dimensional Analytical Geometry: Equation of a sphere – Plane section of a sphere – Tangent Plane - Equation of a cone – Right circular cone – Equation of a cylinder –

Right circular cylinder.

UNITIV 14 Periods

Multiple Integrals: Double integrals – Change of order of integration – Double integral in polar co-ordinates – Area enclosed by plane curves – Triple Integrals. Volume of Solids- Change of Variables-Area of curved surfaces, Calculation of mass.

UNIT V 10 Periods

Beta & Gamma functions : Beta function – Gamma function relation between

Beta and Gamma functions –results and problems, error function.

TEXT BOOK:

1. Dr. B.S. Grewal, Higher *Engineering Mathematics*43rd edition, Khanna Publishers, New Dehli.

REFERENCE BOOKS:

1. N.P. Bali, Dr . Ashok Saxena,Dr.N.Ch.S. Narayana, *A Text book on Engineering Mathematics*Laxmi pub.(p)Ltd. New Dehli
2. H.K.Dass, *Advanced Engineering Mathematics*,S.chand and company Ltd
3. Dr.M.K. Venkataraman, *Higher Engineering Mathematics* National Pub.Co.Madras.
4. Erwin kreyszig. *Advanced Engineering Mathematics* John Wiley and sons Newyork

ENGINEERING CHEMISTRY

(Common for all branches)

ECE 113 **Credits :3**

Instruction : 3 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objectives:

- To provide knowledge on problems associated with impure water and various water treatment technologies
- To provide an understanding on materials and their preparation techniques.
- To provide basic knowledge on conventional energy resources, developments in batteries and fuel cells
- To understand the corrosion of metals, various methods to prevent and control of corrosion
- To create awareness on advanced concepts like nano materials, green chemistry and eco-friendly technologies for future development

Course Outcomes:

By end of the course, student will be able to:	
1.	Adopt suitable technologies for domestic and industrial water
2.	Able to distinguish different material properties to be used in the semiconductor electronic devices.
3.	Use appropriate method for determination of ranking of coal and analyze energy conversion
4.	Select and use of suitable material to prevent corrosion and protecting metals from corrosion.
5.	Develop green technologies for industrial processes.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1				1	1	1	1			1			
	2	2	1				1			1			1			2
	3	2	1				1	2	1	1			1			1
	4	2	1				1	1	1	1			1			1
	5	3	1				1	1		1			1			

SYLLABUS

UNIT I 10 Periods

Water Chemistry: Impurities in water, Hardness of water - units and calcium carbonate equivalents, -estimation of hardness (EDTA method) - disadvantages of hard water, boiler troubles- Scale & Sludge formation - prevention- Internal treatment - (Phosphate, Carbonate and Calgon conditioning) - Caustic embrittlement

Water treatment techniques: Softening of water -lime-soda process -numerical problems on LS

process -Zeolite, -ion exchange methods, Desalination of water – Reverse osmosis and Eelectrodialysis, Municipal water treatment - Screening, sedimentation, coagulation, Sterilization-Chlorination-Break Point chlorination.

UNITII 10 Periods

Solid State Chemistry: Classification of Solids, Band theory of solids. Chemistry of Semiconductors – Intrinsic, extrinsic, compound and defect semiconductors, Organic semiconductors, Purification and preparation of Semiconductor by zone refining – Single crystal growth(Czochralski method) – epitaxial growth. Liquid crystals, LCD, LED and OLED.

Ceramic Materials: Cement-Manufacture of Portland cement - Setting and hardening of cement - Cement concrete - RCC, Refractories - Classification - properties, Ceramics and its Engineering applications.

UNIT III 10 Periods

Thermal Energy: Fuel –types of fuels -Calorific value and its determination (Bomb calorimeter method) Coal- Ranking of coal - analysis (proximate and ultimate) – COKE – Manufacture (Otto Hoffmann‟s process). Petroleum – refining of Crude oil; Synthetic petrol – Fisher - Tropsch and Bergius methods, Knocking in Petrol and Diesel engine – Octane number - Cetane number, LPG and CNG.

Chemical Energy: Electrode potential, electro chemical series – Reference electrodes – SHE, Calomel electrode – Galvanic cells – primary cells (Dry cell) secondary cells (Lead acid, Ni-Cd, Li ion batteries) H_2-O_2fuel cells.

Solar Energy: Construction and Working of Photovoltaic cell

UNIT IV 08 Periods

Corrosion Chemistry: Origin and theories of corrosion – Types of corrosion -Galvanic corrosion, concentration cell corrosion, pitting corrosion, stress corrosion, inter granular corrosion; Factors affecting corrosion – Corrosion

Prevention & Control of Corrosion: Cathodic protection; Corrosion inhibitors; Protective coatings – Galvanization & Tinning –Anodized coatings - paints & special paints

UNIT V 10 Periods

Nano chemistry: Introduction, growth of nanoparticles (Sol-gel process), Fullerenes and Carbon nanotubes

Green chemistry: Principles of Green chemistry, Alternative Solvents used in green synthesis.

Lubricants: Concept of Tribology –ME Chanism of lubrication- Blended oils - properties of lubricating oils -Viscosity Index -Fire & Flash Point -Cloud &Pour Point -Aniline point.

High Polymers &Composites- Basic concepts of Polymers, Effect of polymer structure on properties. Plastics-Thermoplastic and Thermosetting resins, Composites -types- Fiber Reinforced Plastics -Particulate composites -Layer composites, engineering applications of composites.

TEXT BOOK:

1. P.C. Jain and M. Jain *Engineering Chemistry* 16th edition - DhanapathiRai& Sons, Delhi

REFERENCE BOOKS:

1. S.S. Dara*A text book of Engineering Chemistry* 15 the edition, S. Chand & Co. New Delhi
2. O.G.Palanna*Engineering Chemistry* Tata Mcgraw Hill Education pvt ltd, New Delhi.

3. B.K. Sharma *Engineering Chemistry* - Krishna Prakashan Meerut
4. A.K.Bandopadhayay*Nanomaterials* new age international publishers.
5. V.K. Ahluvalia*Green solvents for organic synthesis*Narosa publications.

PROFESSIONAL ETHICS AND HUMAN VALUES

(Common for All Branches)

ECE114 **Credits :3**

Instruction: 2 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objective:

(i) To understand moral values and their significance.
(ii) To draw inspiration for imbibing moral values
(iii) To understand professional ethics and obligations
(iv) To know the code of ethics of relevant Professional societies

Course Outcomes:

By end of the course, student will be able to:	
1.	Understand the right code of conduct.
2.	Assess his/her roles as a proactive member of the society
3.	Solve moral dilemmas and issues
4.	Implement Code of ethics of relevant Professional societies

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**						2		3	1	1		1			
	2						2		3	1	1		1			
	3						2		3	1	1		1			
	4						2		3	1	1		1			
	5						2		3	1	1		1			

SYLLABUS

UNITI Introduction

Philosophical basis for human values- Human values as enshrined in the Gita, Bible and khoran; Religion- Values propounded in various religions- Need for Religious harmony

UNIT II: Human Values: Inspiration

Inspiration for human values- Mahatma Gandhi, Dr.SarvepalliRadha Krishnan, Swami Vivekananda, Rabindranath Tagore, Mother Theresa- Benefits of Human values- Harmony between Self-interest and human values

UNIT III: Basics of Professional Ethics

Ethical Human Conduct – based on acceptance of basic human values; Humanistic Constitution and Endersal human order – skills, sincerity and fidelity; Scope and characteristics of people-frily and eco-frily production system, Technologies and management systems.

UNIT IV: Professional Ethics in practice

Profession and Professionalism – Professional Accountability, Roles of a professional, Ethics and image of profession; Engineering Profession and Ethics - Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world; Professional Responsibilities – Collegiality, Loyalty, Confidentiality, Conflict of Interest, Whistle Blowing

UNIT V: Indian Constitution, Code of Ethics and Global Issues

Indian Constitution: Fundamental Rights and duties, Freedom, Equality, Fraternity, Justice, Directive principles of state policy. Sample code of Ethics by Professional Societies such as ASME, ASCE, IMEC, IETE, Institution of Engineers (India), Indian Institute of Materials Management etc.

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership.

TEXT BOOKS:

1. K.R. Govindan and S.SenthilKumar*Professional Ethics & Human Values*Anuradha Publications.
2. Mike Martin and Roland Schinzinger*Ethics in Engineering*3rd edition, McGraw Hill. New York (2012).

REFERENCE BOOKS:

1. R. Subramanian*Professional Ethics* Oxford Endersity Press.
2. A.N. Tripathy*Human values* 2003, New Age International Publishers
3. S.B. Srivasthva*Professional Ethics & Human Values* SciTech Publications (India) Pvt. Ltd. New Delhi.
4. Prof. D.R. Kiran*Professional Ethics & Human Values* TATA McGraw Hill Education.
5. M. Govindrajran, S Natrajan& V.S. SenthiKumar*Engineering Ethics (including human Values)* Eastern Economy Edition, Prentice hall of India Ltd

ENGINERING PHYSICS

(Common for all branches)

ECE115 **Credits:3**

Instruction : 3 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objectives:

- To impart knowledge in basic concepts of physics relevant to engineering applications
- To introduce advances in technology for engineering applications

Course Outcomes:

By the end of the course, student will be able to:	
1.	Design and conduct simple experiments as well as analyse and interpret data in engineering applications
2.	Apply the concept of electromagnetism for better understanding of advanced topics in engineering courses.
3.	Identify formulae and solve engineering problems
4.	Apply quantum physics to electrical phenomena

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	2		1		2			2		1	1	1	1
	2	3	3	3		1			1		2		1	1	1	1
	3	3	2	2		1					2		1			1
	4	3	2	3		1			1		2		1			1
	5	3	2	1		1					2		1			1

SYLLABUS

UNIT I

Thermodynamics:

Heat and work, first law of thermodynamics and its applications, reversible and irreversible processes, heat engine, Carnot cycle and its efficiency, Carnot‟s theorem, second law of thermodynamics, entropy – entropy change in reversible and irreversible processes, entropy and second law, entropy and disorder, entropy and probability, third law of thermodynamics

UNITII

Electromagnetism:

Faraday‟s law of induction , Lenz‟s law, Integral and differential forms of Faraday‟s law , self-inductance, energy stored in electric and magnetic fields, Poynting vector, displacement current, Maxwell‟s equations in integral form (no derivation), wave equation, propagation of electromagnetic waves in free space

Ultrasonics: Properties of ultrasonic waves, production of ultrasonic waves by magnetostriction and piezoelectric methods, applications of ultrasonics

UNITIII

Optics

Interference: Introduction, principle of superposition, coherence, Young‟s double slit experiment, conditions for interference, interference in thin films by reflection, wedge shaped film and Newton‟s rings

Diffraction: Introduction, Fresnel and Fraunhofer diffraction, diffraction at a single slit

Polarisation: Introduction, types of polarized light, double refraction in uniaxial crystals, Nicol‟s prism, quarter and half-wave plate, production and detection of plane , circular and elliptically polarized light

UNITIV

Lasers: Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, semiconductor laser, applications of lasers

Fibre optics: Introduction to optical fibers, principle of propagation of light in optical fibers,, acceptance angle and acceptance cone, numerical aperture, types of optical fibers, modes of propagation and refractive index profiles, attenuation in optical fibers, advantages of optical fibers in communications, fiber optics communication system, applications of optical fibers, fiber optic sensors

UNIT V

Quantum Mechanics:

Planck‟s hypothesis, wave-particle duality, introduction to quantum theory, de-Broglie concept of matter waves, Heisenberg‟s uncertainty principle, Schrodinger‟s time independent and time dependent wave equations, physical significance and properties of the wave function ψ , application of Schrodinger wave equation for a particle in one dimensional well – eigenwavefunctions and energy eigen values of the particle

Elements of Statistical Mechanics: Elementary concepts of Maxwell-Boltzman , Bose-Einstein and Fermi-Dirac statistics (no derivation)

TEXT BOOKS:

1. S.L Gupta and Sanjeev Gupta *Engineering physics* Dhanpat Rai publications.
2. M.N. Avadhanulu&P.G.Kshirasagar*A text book of engineering physics*, S.Chand publication

3. Resnick&Halliday *Physics*- Volume II

REFERENCE BOOKS:

1) V. Rajendran *Engineering physics* McGrawHill Education Private Ltd

2) S.O.Pilai , Sivakami *Engineering Physics* New Age International Publishers

3) Young & Freedman *University Physics* Pearson Education

4) A. Marikani *Engineering Physics* PHI Learning Private Limited

ENGINEERING CHEMISTRY LAB

(Common for all branches)

ECE 116 **Credits: 2**

Practical / week : 3 Sessional Marks :50

End Exam:3Hrs, End Exam. Marks : 50

Course Objectives:

- To provide clear idea over quantitative chemical analysis.
- To improve skills in analyzing samples through titration procedures.
- To familiarize with Instrumental methods of analysis for more accuracy.
- To introduce various methods of analyzing the ore samples.

Course Outcomes:

By end of the course, student will be able to:	
1.	Able to identify the suitable method for analyzing samples.
2.	Able to analyze different types of water samples to test quality parameters.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	1		1		1		1	1	1					
	2	2	1		1		1		1	1	1					

List of Experiments (any 10 experiments are to be completed):

1. Preparation of standard solution
2. Estimation of sodium carbonate present in soda ash.
3. Estimation of amount of calcium present in the Portland cement by titrimetrically.
4. Estimation of amount of Copper present in the Copper ore by Iodometrically.
5. Determination of total Hardness present in the given water sample.
6. Estimation of amount of Zinc by titrating with EDTA.
7. Determine the strength of acid by titrating with strong base using **pH meter**.
8. Estimate the individual strength of acids present in the acid mixture by titrating with strong base using **conductivity meter.**
9. Estimate the amount of Mohr's salt present in the given solution by titrating with potassium dichromate using potentiometer.
10. Determination of viscosity of the given liquid by Ostwald viscometer.
11. Determination of rate constant of acid catalyzed hydrolysis of ester.
12. Determination of partition coefficient of iodine distributed between Water and Carbon tetra chloride.

Demonstration

13. Estimation of amount of dissolved oxygen (D.O) present in the given water sample.
14. Synthesize the Phenol-Formaldehyde resin.

TEXT BOOKS:

1. S.K. Bhasin and SudhaRani*Laboratory manual on Engineering chemistry*, third edition DhanpatRai Publishing Company.

REFERENCE BOOKS:

1. S.S. Dara*Experiments and calculations in Engineering chemistry* 9th edition S. Chand& Company ltd.

PROGRAMMING WITH C LAB

(Common for all branches)

ECE 117 **Credits:3**

1Tut/Week & 3Practical / week Sessional Marks :50

End Exam:3Hrs, End Exam. Marks : 50

Course objective:

To enable students to

- Understand the program development steps using compilers.
- Strengthen the problem solving skills using programming techniques.
- Design programs using various control structures.
- Develop programs using structures, unions and files.

Course outcomes:

By the end of the course, student will be able to:	
1.	Acquire working knowledge on programming.
2.	Apply fundamentals of a programming language (such as language-defined data types (int, float, char, double), control constructs (sequence, selection, repetition), program modules (including functions, modules, methods)).
3.	Exhibit the ability to formulate a program that correctly implements the algorithm.
4.	Demonstrate the effective use the programming environment used in the course.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	2	3		1	1	1	2	1		1			1
	2	1	2	2	2	1										1
	3	2	1	2	1	2								1	1	
	4	2	3	2	2	2	2	2	2	3	3		2	1	1	1

SYLLABUS:

1. Overview
2. Introduction to Unix
3. Data Types, Constants
4. Operators, Expressions
5. Control Structures
6. Arrays & Strings
7. Pointers
8. Functions.
9. Structures & Unions
10. Files

REFERENCE BOOKS:

1. YashwantKanetkar*Let Us C* 5th Edition.

2. V.Rajaraman*Fundamentals of Computers* 4th Edition, PHI 2005.

3.Programming Techniques through C, M.G. V. Murthy, Pearson Education, 2002

4.KRVenugopal, SR Prasad *Mastering C* Tata McGraw Hill.

5.B.W. Kernighan, Dennis M. Ritchie *The C – Programming Language* PHI

LIST OF SAMPLE PROGRAMS

1. Write a C program for any three of the following
   - i) To accept the distance between two cities and convert the distance in meters, feet, inches and centimeters. (Note: Input distance in Kilometers).
   - ii) To accept the marks obtained by a student in five different subjects, calculate the total marks and percentage obtained by the student (The maximum marks for each subject is 100).
   - iii) To accept a 3-digit number and calculate the sum of its digits.
   - iv) To accept quantity, product code, unit price of five products and calculate the total price for each product and the SUBTOTAL, TAX, TOTAL and print the details in the following format

Qty	Product code	Unit price	Total price
xx	1	400.00	xxxx.xx
xx	2	20.00	xxxx.xx
xx	3	200.00	xxxx.xx
xx	4	100.00	xxxx.xx
xx	5	200.00	xxxx.xx

		SUB TOTAL	xxxxx.xx
		TAX	xxxx.xx
		TOTAL	xxxxx.xx

   - v) To evaluate the following expression
     - a) (ax + by) / (ax – by)
     - b) $a^2 + b^2$ + squareroot(2ab)
     - c)

2. Write a C program for any three of the following
   - i) To find the maximum and minimum of three numbers.
   - ii) For the above experiment in 1-ii) find and display the grade of the student as prescribed below:

Percentage	Grade
>90	A
>80 and <=90	B
>70 and <=80	C
>60 and <=70	D
>=50 and <=60	E
< 50	F

iii) To find the roots of a quadratic equation.
iv) To find the area of a triangle when
   a) Sides are given
   b) Base and height are given
   c) Co-ordinates are given
v) To accept an alphabet and convert into its opposite case.
(Do not use library functions)

3. Write a C program for any four of the following
   i) To print prime numbers between the specified range (eg. 100 to 200)
   ii) To generate Pascal triangle format
   iii) To compute cosine series: $\cos(x)= 1- x^2/2! + x^4/4! – x^6/6! + \ldots$
   iv) To check whether number is palindrome or not.
   v) To print set of Armstrong numbers in a specified range. (eg. 100 to 200)
   vi) To convert the numbers from the following
      a) Binary to decimal
      b) Decimal to binary
4. Write a C program to perform the following operations in a given array of ‟n‟ numbers
   i) Sum of all the numbers
   ii) Minimum and maximum in the array
   iii) Searching an element
   iv) To generate random real numbers in the range of 10 to 20 and sort them.
5. Write a C Program to perform the following on the matrices
   i) Transpose of a matrix and check the symmetry
   ii) Trace and norm of a matrix
   iii) Addition of matrices
   iv) Multiplication of two matrices
6. Write a C program to perform any two of the following operations on strings (not using library functions)
   i) To check whether the given string is palindrome or not.
   ii) To find the length of the string
   iii) To concatenate two strings.
   iv) To check whether the given substring exists in a text and display the frequency.

7.
   i) Write a C program to create a structure for a student with the details name, roll no five subject marks, total marks, percentage and sort the records according to the percentage.
   ii) Write a C program to add two complex numbers using structures.
   iii) Write a C program to illustrate difference between union and structure.
8.
   i) Write a program to calculate the sum of an array using pointers.
   ii) Write a program to search a name in a given list of names using pointers
9. Write a C program using functions

i) To illustrate call by value and call by reference

ii) To accept a string and character and pass them as parameters to a function, the function shall replace the character in the string with any other specific character and return the modified string.

iii) To pass the employee record as a structure to the function. The function shall compute the gross salary (include DA and HRA Calculation), take the savings as input and compute the tax payable as per the prescribed table.

Gross Salary	**Tax (%)**
Less than 2 Lakhs	NIL
2 Lakhs to 5 Lakhs	10
5 Lakh to 10 Lakh	20
10 Lakhs to 50 Lakhs	30
Above 50 lakhs	50

Note: The employee record shall contain employee name, employee id, hire date, basic salary, DA, HRA.

10. Write a C program for any one program for the following to illustrate recursion
   i) Factorial of a number
   ii) GCD and LCM of two numbers
   iii) Fibonacci series

11. Write a C program to perform any three of the following on files
   i) To count the number of alphabets, numbers, words, lines in a given file.
   ii) To merge two files into third auxiliary file and display the content.
   iii) To print every even position character in a given file.
   iv) To separate alphabets and integers into two files from the given source file.
12. Write a C program to update the record of a person in a file by accepting person ID.
   Hint:
   1. Create the file with few records.
   2. The fields in a record
      a. Name of the person
      b. Identity(ID) of the person
      c. Age
      d. Gender
      e. Occupation
      f. Salary

ENGINEERING MATHEMATICS-II

(Common for all branches)

ECE121 **Credits :3**

Instruction : 3 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objectives:

- To impart knowledge in basic concepts of solving linear system of equations.
- To enable the students to study the eigen values and eigen vectors of matrix.
- To introduce the concepts of ordinary differential equations and their applications to engineers.
- To enable the students to solve any higher order differential equations and to solve differential equations related to simple electric circuits, Newtons law of cooling.
- To introduce the students to Laplace Transforms and their applications.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Solve linear system equations using of matrix algebra techniques
2.	Determine the Eigen values and vectors of a matrix
3.	Apply different techniques in solving differential equations that model engineering problem
4.	Apply the Differential equations in applications like simple electric circuits, Newtons law of cooling and to solve any higher linear ordinary differential equation with constant coefficients
5.	Solve linear differential equations and Network analysis using Laplace transforms.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2										1	3	3	2
	2	3	2										1	3	3	2
	3	3	2		1								1	3	3	2
	4	3	2		1								1	3	3	2
	5	3	2		1								1	3	3	2

SYLLABUS

UNIT I

Linear Algebra: 11 Periods

Rank of matrix-Elementary Transformation of a matrix- Gauss Jordan Method of finding the inverse – Normal form of the matrix- PAQ form – Consistency of linear system of equations – System of homogeneous and non- homogeneous equations .

UNIT II 12 Periods

Linear transformations – Orthogonal transformations- Vectors (Linearly Independent & Dependent) ,Eigen values , Eigen Vectors, Properties of Eigen values – Cayley Hamilton theorem (without proof).Reduction to diagonal form – Reduction of Quadratic form to canonical form – Nature of quadratic form,.

UNIT III 10 Periods

Differential Equations of first order:
First order Linear differential equations , Bernoulli‟s equations , Exact Differential Equations –Equations reducible to exact Equations - Orthogonal trajectories – Simple Electric circuits- Newton law of cooling.

UNIT IV 10 Periods

Higher order Linear Differential Equations

Definitions – Rules for finding the complementary function, rules for finding the particular integral, method of variation of parameters, equations reducible to linear equations with constant coefficient - Cauchy‟s homogeneous linear equation ,Legendre‟s linear equation.

UNIT V 17 Periods

Laplace Transforms:

Introduction – definitions- Transforms of elementary functions - Properties of Laplace transforms- Transforms of Periodic functions –Transforms of Derivatives – Transforms of Integrals- Multiplication by t^n - division by t -Evaluation of integrals by Laplace transforms. Inverse Laplace transforms – Other methods of finding inverse transforms (Excluding Residue method) Convolution theorem – Application‟s to Differential Equations – Unit Step function- Unit Impulsive functions.

TEXT BOOK:

1. Dr. B.S. Grewal*Higher Engineering Mathematics*43rd edition, Khanna Publishers, New Dehli.

REFERENCE BOOKS:

1. N.P. Bali, Dr . Ashok Saxena,Dr.N.Ch.S. Narayana, *A Text book on Engineering Mathematics*Laxmi pub.(p)Ltd. New Dehli.
2. H.K.Dass, *Advanced Engineering Mathematics*,S.chand and company ltd
3. Dr.M.K. Venkataraman, *Higher Engineering Mathematics* National Pub.Co.Madras.
4. Erwin kreyszig. *Advanced Engineering Mathematics*John Wiley and sons ,Newyork.

APPLIED PHYSICS

(for ECE, EEE &Mech)

ECE122 **Credits :3**

Instruction: 3 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objectives:

- To enhance student‟s knowledge of theoretical and modern technological aspects in physics and to introduce fundamentals of physics relevant to engineering applications
- To introduce advances in technology for engineering applications

Course Outcomes:

By end of the course, student will be able to:	
1.	Find the different magnetic and super conducting materials to enhance the performance
2.	Identify and improve the dielectric materials for insulating, mechanical and communication applications
3.	Synthesize and characterize nano phase materials for industrial applications
4.	Apply the basic crystalline structure and its relation to the properties of the materials
5.	Design various semiconductor devices for engineering applications.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	1	0	0	0	0	0	2	0	0	1			
	2	3	2	1	0	0	0	0	0	2	0	0	0			
	3	3	1	0	0	2	0	0	0	2	0	0	1			
	4	3	1	0	0	0	0	0	0	2	0	0	0			
	5	3	2	2	0	0	0	0	0	2	0	0	1			

SYLLABUS

UNITI

Magnetic materials: Definition of magnetic permeability, magnetization and magnetic susceptibility, origin of magnetic moment, classification of magnetic materials, properties of diamagnetic and paramagnetic materials, ferromagnetic materials - hysteresis curve , domain theory of

ferromagnetism, soft and hard ferromagnetic materials, anti-ferromagnetic and ferrimagnetic materials , ferrites and its applications

Superconductivity: Introduction, properties of superconductors, effect of temperature and magnetic field, Meissner effect, flux quantization , type – I and type – II superconductors high temperature superconductors, applications of superconductors, BCS theory (qualitative)

UNITII

Dielectric materials: Definition of electric dipole moment, dielectric polarization and dielectric constant, types of polarization – electronic, ionic and oriental polarization, expression for polarisability, internal fields in solids, Classius – Mossotti equation, frequency dependence of electronic polarization ,properties of ferroelectric materials and their applications

UNIT III

Nanophase materials: Introduction to nanophase materials, properties of nanophase materials, synthesis of nanophase materials – chemical vapour deposition, sol-gel method, MEChanical attrition method, applications of nanophase materials. Principles of X-Ray florescence X-Ray Diffraction-Electron Microscopy (SEM and TEM)

UNIT IV

Crystal structure: Introduction, fundamental terms of crystallography – space lattice, , crystal lattice, unit cell, planes, seven crystal systems – Bravias lattices, cubic lattices, crystal directions and planes, Miller indices, interplanar spacing and interatomic distance , some simple crystal structures, body-centered cubic crystals, face-centered cubic crystals

UNIT V

Semiconductor Physics: Intrinsic and extrinsic semiconductors, Fermi level, carrier concentration in intrinsic semiconductor, continuity equation, direct and indirect band gap semiconductors. Lorentz force, Hall effect and its applications.

Physics of semiconductor devices: open circuited p-n junction diode, energy diagram of p-n diode, working of a diode, volt-ampere characteristics of p-n junction, diode as a rectifier, light emitting diode (LED) , liquid crystal display (LCD), photodiode

TEXTBOOKS:

1. S.L Gupta and SanjeevGupta*Engineeringphysics*DhanpatRai publications.
2. M.N. Avadhanulu&P.G.Kshirasagar*A text book of engineering physics*, S.Chand publication

REFERENCE BOOKS:

1. V.Rajendran*Engineering physics* Tata McGraw Hill Education Private Limited
2. DattuRamanlal Joshi *Engineering Physics* Tata McGraw Hill Education Private Limited
3. A.Marikani*Engineering Physics* PHI Learning Private Limited

ENVIRONMENTAL SCIENCES

(Common for all branches)

ECE123 **Credits 3**

Instruction : 3 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objectives:

- To gain knowledge on the importance of environment and ecosystems.
- To acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of interdependence.
- To acquire knowledge about environmental pollution- sources, effects and control measures of environmental pollution
- To understand the treatment of wastewater and solid waste management.
- To be aware of the national and international concern for environment for protecting the environment

Course Outcomes:

By the end of the course, student will be able to:	
1.	Acquire the knowledge about the natural environment and its relationships with human activities.
2.	Characterize and analyze human impacts on the environment.
3.	Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems
4.	Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**						1	2	1	1	1		1			
	2						1	2	1	1	1		1			
	3						2	2	1	1	1		1			
	4						2	3	1	1	1		1	1	1	1
	5						2	2	1	1	1		1			

SYLLABUS

UNIT I

INTRODUCTION TO ENVIRONMENT AND NATURAL RESOURCES 10 Periods

Introduction: Definition, Multidisciplinary nature, Scope and Importance of Environmental Sciences- R & D in environment, green advocacy, green marketing, green media and environment consultancy.

Need for public awareness.

Natural Resources: Forest resources-use and overexploitation, deforestation, Big Dams effects on forests and tribal people. Water resources-sources, use and over utilization of surface and ground water, conflicts over water, dams-benefits and problems. Food resources-environmental impact of modern agriculture-fertilizer and pesticides. Land resources-land degradation- landslides, soil erosion and desertification. Energy resources- renewable and non-renewable energy resources and use of alternate-energy sources.

UNIT II 10 Periods

ECOSYSTEM & BIO DIVERSITY

Ecosystem: Concept of an ecosystem-structure and function of an ecosystem Food chains, food webs and ecological pyramids, Energy flow in an ecosystem, Ecosystem regulation, Ecological succession. Types, characteristic features, structure and function of forest, grass land, desert and aquatic ecosystems.

Biodiversity-definition, types, India as a Mega diversity Nation, Values of biodiversity, Hot spots of biodiversity, Threats to biodiversity-habitat loss, poaching, human-wildlife conflicts, Endangered and endemic species, Conservation of biodiversity.

UNIT III

ENVIRONMENTAL POLLUTION AND WASTE MANAGEMENT 10 Periods

Sources, effects and control measures of Air pollution, Noise Pollution, Soil Pollution, Marine pollution, Thermal pollution, Radio Active Pollution. Water Pollution (Sources, Effects, Control measures, DO, BOD, COD, sewage treatment), Green house effect, Ozone depletion, Acid rain – causes and adverse effects.

Solid waste management: Sources and effects of municipal waste, bio-medical waste, Industrial waste,

e-waste, Process of waste management-composting, sanitary landfills, incineration.

UNIT IV

SOCIAL ISSUES AND ENVIRONMENT 8 Periods

Social Issues and the Environment: From unsustainable to sustainable development, Environmental Impact Assessment, Water conservation, Rain water harvesting, water shed management. Resettlement and rehabilitation of people, Environmental ethics.

Urbanization, Industrialization, Transportation, Human population and the environment-population growth, role of information technology in environment and human health.

UNIT V

LEGISLATIONS, CONVENTIONS & CASE STUDIES 10 Periods

Environmental protection act-Air (prevention and control of pollution) act, Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act.

International Conventions: Stockholm Conference, Brundtland Commission, Rio declaration, Vienna Convention, Kyoto protocol, Johannesburg Summit.

Case Studies: Chipko Moment, Kolleru Lake, Flourosis, Silent valley project, Narmada BachoAndolan, Ralegeon siddhi, Tehri dam, Madhura refinery and Tajmahal

TEXT BOOK:

1. AnubhaKaushik&C.P.Kaushik*Principles of Environmental Studies*New Age International Publications.

REFERENCE BOOKS:

1. B.K. Sharma *Environmental chemistry*Goel publishing house, Meerut, 2001.
2. G. S. Sodhi*Fundamental concepts of Environmental Chemistry*, Narosa publishing house, New Delhi
3. S .S.Dara*A text book of Environmental Chemistry and pollution control*S.Chand and Company Ltd, New Delhi, 2002.

ENGINERING DRAWING

(Common for all branches)

ECE124 **Credits :3**

Instruction : 1 Periods(Theory)+3 Periods(Practical) Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objectives:

- To increase ability to communicate with people and learn to sketch and take field dimensions.
- To make the student familiar to the drawing practices and convection
- To familiarize the student about various engineering curves used in industry
- To enable the student draft simple engineering components and analyze different views of components.
- To introduce basic Auto CAD skills.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Construct various engineering curves and understand the basic geometrical constructions
2.	Prepare orthographic projections of points and lines
3.	Prepare orthographic projections of plane surfaces
4.	Prepare orthographic projections of solids in various orientations
5.	Develop isometric projections and understand basics of Computer Aided Drafting

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1	1	2				1		1		1			
	2	3	2	1	2				1		1		1			
	3	3	2	1	2				1		1		1			
	4	3	2	1	2				1		1		1			
	5	3	2	1	2	1			1		1		1			

SYLLABUS

UNIT I

Introduction to Engineering Drawing & basics of geometrical construction.

construction of conic sections-Construction of cycloidal curves, involutes & spirals.

UNIT II

Orthographic projections – projections of points – projections of straight lines

UNIT III

Projections of planes – perpendicular planes – oblique planes

UNIT IV

Projection of solids – Prisms – Cylinder– Pyramids & cones

UNIT V

Isometric projections – Plane solids, Combination of solids

Demonstration & Practice: Computer aided drafting of lines, planes solids and

Dimensioning.

TEXT BOOK:

1. N. D. Bhatt *Engineering Drawing* Charotar Publishing House Pvt. Ltd, 53rd Edition : 2014

REFERENCE BOOKS:

1. K. L. Narayana& P. Kanniah*Engineering Drawing*
2. R. B. Choudary*Engineering Graphics with Auto CAD*
3. TrymbakaMurty*Computer Aided Engineering Drawing*

BASIC ELECTRONICS ENGINEERING

(for IT,CSE& ECE branches)

ECE125 **Credits :3**

Instruction : 3 Periods & 1 Tut/Week Sessional Marks :40

End .Exam :3 Hours End-Exam-Marks:60

Course Objectives:

- To familiarize the students about different discrete electronic components and CRO.
- To familiarize the students with the analysis and design of Rectifier Circuits.
- To train the students with the operational principle, analysis, design and applications of different types of Diodes.
- To train the students the operational principle, analysis, design and application of different field effect transistors (FET) and circuits using FETs & bipolar junction transistor (BJT).
- To familiarize the students about Analog ICs.

Course Outcomes:

At the end the student will be able to	
1.	Analyze behaviour of passive electrical components such as resistors,capacitors and inductors and understand carrier transport phenomenon in semiconductors.
2.	Illustrate the principle of operation of measuring instruments such as volt meters, ammeters power supplies, CRO etc used to measure electrical parameters according to the range selected.
3.	Illustrate the characteristics and working principles of semiconductor diodes and determine their parameters.
4.	Bias the transistor such as BJT, JFET and MOSFET in the desired operating region using any of the available biasing techniques.
5.	Analyze the characteristics of Integrated circuits and its use in several applications in electronics circuits particularly the IC Op- Amp and 555 timer, IC voltage regulators etc.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1													1
	2	2														1
	3	2														1
	4	3														1
	5	3	2													2

SYLLABUS

UNITI: Electronic Components 8 periods

Resistors: Types of Resistors- The resistor color code, Variable resistors, Rheostat and Potentiometers,

Resistance, Tolerance, Resistivity, Power Ratings of Resistors, Resistor troubles, Ohms Law: Linear proportion between V and I, Choosing a resistor for a circuit, Electric Shock,, Open circuit and Short circuit troubles.

Capacitors: Capacitance, charging and discharging, Typical capacitors, Capacitor Coding, Parallel capacitances, Series capacitances, Energy stored in Electrostatic Field of Capacitance, Measuring and Testing of Capacitors.

Inductors: Self and Mutual Inductance

Semiconductors: Mass Action Law, Mobility, Conductivity, Drift current and Diffusion current, Hall-Effect

UNIT II: Electronic Instruments 8 periods

Types of wire conductors, Connectors, Printed wiring, Switches, Fuses, Wire resistance, Introduction to batteries, Introduction to CRO,CRT, Soldering Materials, Soldering Tools.

UNITIII: Diodes and Applications 8 periods

Semiconductor Materials, The PN Junction Diode, Volt-Amp characteristic curve, Diode approximations, Diode ratings, Rectifier Circuits, Special Diodes.

UNITIV: Transistors 10 periods

Transistor Construction, Transistor Operating region, Transistor Ratings, Transistor Biasing Techniques, Small signal amplify operation, CB,CC,CE configurations, JFET and their Characteristics, Biasing techniques for JFET, MOSFET and their Characteristics, MOSFET Biasing techniques.

UNITV: Integrated Circuits 14 periods

Advantages of ICs over discrete components, Introduction to Op-amp, Differential Amplifiers, Block diagram and Characteristics of Op-Amp, Inverting and Non inverting modes, Virtual ground, CMRR, Slew rate, IC 555 Timer, Block daigram, Modes of operation of IC55, OP-AMP voltage Regulators, Fixed Voltage Regulators (78/79, XX).

TEXT BOOKS:

1. Mitchel E SchultzGrob‟s*Basic Electronics*, Tata McGraw hill Edition, 10th Edition – (Unit I,II,III,IV)
2. RamaKant A Gayakwad, *Op-Amps and Linear Integrated Circuits*, PHI Fourth Edition-(Unit V)

REFERENCE BOOKS:

1. RG Gupta(2001) *Electronic Instruments and Systems*, Tata McGraw Hill –(Unit II)
2. David A Bell (2008) *Electronic Devices and Circuits*, Oxford University Press. (Unit I,III,IV).

ENGINEERINGPHYSICS LAB

(Common for all branches)

ECE126 **Credits: 2**

Practical / week : 3 Sessional Marks :50

End Exam:3Hrs End Exam. Marks : 50

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments

Course Outcomes:

By the end of the course, student will be able to:	
1.	Ability to design and conduct experiments as well as to analyze and interpret data.
2.	Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2		2	1			1	1	2			1	1	1
	2	3	2		2				1	1	2					

List of experiments (any eight to ten experiments are to be completed)

1. Determination of coefficient of thermal conductivity of a bad conductor- Lee‟s method.
2. Determination of radius of curvature of a convex lens - Newton‟s rings.
3. Determination of wavelengths of spectral lines in mercury spectrum-using diffraction grating in normal incidence position.
4. Determination of Cauchy‟s constants of the material of the prism using spectrometer.
5. Determination of thickness of a thin paper by forming parallel interference fringes-Wedge method.
6. Study of variation of magnetic field along the axis of a current carrying circular coil – Stewart and Gee‟s apparatus
7. Calibration of a low-range voltmeter using potentiometer.
8. Verification of laws of resistance and determination of specific resistance of wire by using Carey-Foster‟s bridge.
9. Determination of refractive indices o-ray and e-ray in quartz crystal (double refraction)
10. Determination of the frequency of an electrically maintained tuning fork - Melde‟s experiment.
11. Determination of Rydberg constant using hydrogen discharge tube.
12. Characteristics of photo cell and determination of Planck‟s constant –Photoelctric effect.
13. Determination of e/m of an electron by Thomson‟s method
14. Determination of band gap of semiconductor.

TEXT BOOK:

1. Physics Laboratory Manual prepared by Department of Physics ANITS

REFERENCE BOOKS:

1. D.P Siva Ramaiah and V. Krishna Murthy *Practical physics*Maruti book Depot
2. A.R Vegi*Comprehensive practical Physics*Vegi Publishers Pvt.Ltd.

LANGUAGE LAB

(Common for all branches)

ECE127 **Credits: 2**

Practical / week : 3 Sessional Marks :50
EndExam:3Hrs End Exam. Marks : 50

Course Objectives:

- To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning.
- To improve the fluency in spoken English and neutralize mother tongue influence
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking.
- To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.
- To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Communicate effectively in different formal and informal situations.
2.	Comprehend, interpret and evaluate information by practicing effective listening skills.
3.	Speak English with correct pronunciation and neutralized accent.
4.	Narrate, describe and report incidents and situations using appropriate terminology.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1		2							3	3					
	2		2								3					
	3									3	3					
	4		3		2		2			2	3		3			

SYLLABUS

I CALL (Computer Aided Language Learning)

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.

2. Introduction to Stress and Intonation.

3.Short and long Reading comprehension exercises (listening skills)

4. Telephoning Skills.

II CSL (Communication Skills Lab)

5.„Just A Minute" Sessions (JAM).

6. Describing Objects / Situations / People.

7 Video talks

8. Situational Dialogues / Role Play.

9. Oral Presentations- Prepared and Extempore.

Suggested Software

- Cambridge Advanced Learners" English Dictionary with CD.
- English Phonetics and Phonology – 2 CDs set
- English Mastery – Alania ABC
- Telephoning English
- Cambridge Grammar of English (Ronald Carter and Michael McCarthy) CD
- English Grammar in Use -Cambridge University Press
- Communication Skills – Oxford U P (Sanjay Kumar and PushpaLatha)

REFERENCE BOOKS:

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems)

1. *Spoken English (CIEFL)* in 3 volumes with 6 cassettes, OUP.
2. Daniel Jones *English Pronouncing Dictionary* Current Edition with CD.
3. R. K. Bansaland J. B. Harrison, *Spoken English*-Orient Longman 2006 Ed.
4. Dr A Ramakrishna Rao, Dr G Natanam& Prof SA Sankaranarayanan*English Language Communication : A Reader cum Lab Manual*Anuradha Publications, Chennai
5. Krishna Mohan & NP Singh *Speaking English Effectively* (Macmillan)
6. J. Sethi, KamleshSadanand& D.V. Jindal*A Practical Course in English Pronunciation, (with two Audio cassettes)* Prentice-Hall of India Pvt. Ltd., New Delhi.
7. T. Balasubramanian*A text book of English Phonetics for Indian Students* (Macmillan).
8. *English Skills for Technical Students*, WBSCTE with British Council, OL
9. J.K. Gangal *A Practical Course in Effective English Speaking Skills* PHI.

OBJECT ORIENTED PROGRAMMING WITH C++ LAB

(Common for all branches)

ECE 128 **Credits:3**

Instruction : 1Tut/Week & 3Practical / week Sessional Marks :50

End Exam:3Hrs End Exam. Marks : 50

Course Objective:

- To introduce Object Oriented Programming (OOP) using the C++ Language.
- To provide the basic concepts and techniques which form the Object Oriented Programming paradigm.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Illustrate the concept of OOP paradigm using class, object, data and functions.
2.	Design CPP programs to implement OOP Concepts such as function overloading, operator overloading, Inheritance, virtual functions and polymorphism.
3.	Develop CPP programs to solve real-world problems.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2		1	3					2			1			
	2	2	2	3	3	2	1			1			1			
	3	2	3	3	3	2	2	1	1	3	1		2	1	1	1

SYLLABUS:

List of the experiments to be done on the following topics

1. Overview (Transition from C)
2. OOP Concepts and Characteristics,
3. Preprocessor , Command line arguments
4. Classes & Data Abstraction,
5. Objects,
6. Operator Overloading,
7. Inheritance,
8. Virtual Functions & Polymorphism,
9. I/O Streams,
10. Templates,
11. File Processing,
12. Exception Handling Concepts

REFERENCE BOOKS:

1. Mahesh Bhave , Sunil patekar*Object Oriented Programming in C++* Second edition , Pearson
2. R Rajaram, *Object Oriented Programming in C++* 2nd Edition New Age International Publishers

3. Herbert Schildt*C++ the Complete Reference* III edition, TMH 1999
4. E Balaguruswamy*Object Oriented Programming with C++* 3rd Edition , McGraw Hill

LIST OF SAMPLE PROGRAMS

1. Write a C++ program that uses a recursive function for solving Towers of Hanoi problem.

2. Write a C++ program to find both the largest and smallest number in a list of integers.

3. Write a C++ program that uses function templates to solve problems 1 and 2 experiments

4. Write a C++ program to implement the matrix ADT using a class. Use operator overloading for implementation

5. Write the definition for a class called **Rectangle** that has floating point data members length and width. The class has the following member functions:
   void setlength(float) to set the length data member
   void setwidth(float) to set the width data member
   float perimeter() to calculate and return the perimeter of the rectangle
   float area() to calculate and return the area of the rectangle
   void show() to display the length and width of the rectangle
   intsameArea(Rectangle) that has one parameter of type Rectangle. sameArea returns 1 if the two Rectangles have the same area, and returns 0 if they don't.
   1. Write the definitions for each of the above member functions.
   2. Write main function to create two rectangle objects. Set the length and width of the first rectangle to 5 and 2.5. Set the length and width of the second rectangle to 5 and 18.9. Display each rectangle and its area and perimeter.
   3. Check whether the two Rectangles have the same area and print a message indicating the result. Set the length and width of the first rectangle to 15 and 6.3. Display each Rectangle and its area and perimeter again. Again, check whether the two Rectangles have the same area and print a message indicating the result

6. Create a class called MusicIns to contain three methods string(),wind() and perc(). Each of these methods should initilialize string array to contain the following
   i. Veena, guitear, sitar, sarod and mandolin under string
   ii. Flute, clarinet, saxophone, nadaswaram and piccolo under wind
   iii. Table, mridangam, bangos, drums and tambour under perc
   It should also display the contents of the arrays initialized , create a sub class call TypeIns to contain a method called get() and show(). The get() methods must display a menu as follows

   - String instruments
   - Wind instruments
   - Percussion instruments

The show method should display the relevant details according to user choice .the base class variable must be accessible only to its derived classes.

7. Create a base class called shape. It should contain two methods getCoord(), showCoord() to accept x and y co ordinates and to display the same respectively . Create a sub class called Rect. It should contain method to display length and breadth of the rectangle called showCoord() . In main method, execute the showCoord() of Rect class by applying the dynamic method dispatch concept

8. Create a class called car. Initialize the color and body attributes to “blue” and “wagon”. there should be two constructors one is a default the creates blue wagon the other constructor should take two argcolor, body and initialize. write method toString() that returns the color and body. Create a sub class funcar. In sub class there are two constructors to invoke super class constructors resp. Write a method playCD in sub class that displays the message “Beautiful music fills the passenger compartment” execute the methods to show the messages
    1. Mycar is a blue wagon
    2. My father‟s car is red convertible.

9. Create the ZooAnimal constructor function. The function has 4 parameters -- a character string followed by three integer parameters. In the constructor function dynamically allocate the name field (20 characters), copy the character string parameter into the name field, and then assign the three integer parameters to cageNumber, weightDate, and weight respectively.
10. Write a C++ program to perform operations on complex numbers using operator overloading
11. Write a C++ program to write number 1 to 100 in a data file NOTES.TXT

12. Write a function in C++ to count and display the number of lines not starting with alphabet 'A' present in a text file "STORY.TXT".
    Example:
    If the file "STORY.TXT" contains the following lines,
    The rose is red.
    A girl is playing there.
    There is a playground.
    An aeroplane is in the sky.
    Numbers are not allowed in the password.

    The function should display the output as 3

WORKSHOP

(Common for all branches)

ECE129 **Credits: 2**

Practical / week : 3 Sessional Marks :50

End Exam:3Hrs EndExam. Marks : 50

Course Objective:

- To provide training and hands on experience to the students on basic Engineering related skills like carpentry, fitting, house wiring and tin smithy.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Make different carpentry joints.
2.	Make simple fitting jobs
3.	Make jobs like funnel, elbow etc. using sheet metal.
4.	Apply basic electrical engineering knowledge for house wiring practice like stair case wiring, series and parallel connections.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	2	1	1	1		1				1			
	2	3	2	2	1	1	1		1				1			
	3	3	2	2	1	1	1		1				1			
	4	3	2	2	1	1	1		1				1			

LIST OF EXPERIMENTS

Minimum of three exercises has to be conducted from each trade.

Trade:

Carpentry

1. Cross Lap Joint
2. Dovetail Joint
3. Mortise and Tennon Joint
4. Briddle Joint

Fitting

1. V Fit
2. Square Fit

	3. Half Round Fit
	4. Dovetail Fit
House Wiring	1. Parallel / Series Connection of three bulbs
	2. Stair Case wiring
	3. Florescent Lamp Fitting
	4. Measurement of Earth Resistance
Tin Smithy	1. Taper Tray
	2. Square Box without lid
	3. Elbow
	4. Funnel

SECOND YEAR SYLLABI

I Semester

&

II Semester

Second Year I - Semester

Code	Subject name	Instruction periods perweek					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE211	Engineering Mathematics-III	BS	3	1	-	4	40	60	3
ECE212	Electrical Machines	ES	3	1	-	4	40	60	3
ECE213	Data structures	ES	3	1	-	4	40	60	3
ECE214	Signals and Systems	PC	3	1	-	4	40	60	3
ECE215	Network analysis and synthesis	ES	3	1	-	4	40	60	3
ECE216	Electronic Circuits and Analysis-I	PC	4	1	-	5	40	60	4
ECE217	Electronic Circuits and Analysis-I Laboratory	PC	-	-	3	3	50	50	2
ECE218	Network & Electrical Machines Laboratory	ES	-	-	3	3	50	50	2
Total			19	6	6	31	340	460	23

Second Year II - Semester

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE221	Engineering Mathematics –IV	BS	3	1	-	4	40	60	3
ECE222	Electronic Circuits and Analysis-II	PC	3	1	-	4	40	60	3
ECE223	Digital Electronics	PC	3	1	-	4	40	60	3
ECE224	Probability Theory & Random Processes	PC	3	1	-	4	40	60	3
ECE225	Electromagnetic Field Theory & Transmission Lines	PC	3	1	-	4	40	60	3
ECE226	Control Systems	ES	3	1	-	4	40	60	3
ECE227	Electronic Circuits and Analysis-II Laboratory	PC	-	-	3	3	50	50	2
ECE228	Simulation Laboratory	PC	-	-	3	3	50	50	2
	Massive Open Online Course (MOOC)	AC	-	-	-	-	-	-	-
Total			18	6	6	30	340	460	22

*MOOCs: Course any time during 2-2 to 4-2. But its grade will be accorded with the 4-2 courses of the program.

ENGINEERING MATHEMATICS –III	
ECE 211	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To develop mathematical skill so that students are able to apply mathematical methods & principles in solving problem from engineering fields.

Course Outcomes:

By the end of the course student should be able to:	
1.	Apply the concepts of Gradient, Divergence and Curl and finding scalar potential function of irrrotational vector fields.
2.	Apply the concepts of Green‟s Theorem, Stokes‟ Theorem and the Divergence Theorem and to evaluate line integrals, surface, integrals and flux integrals.
3.	Apply basic techniques for solving linear partial differential equations and how to identify a partial differential equation in order to determine which technique(s) can best be applied to solve it.
4.	Apply the concept of Partial differential equations to solve the Laplace, heat, and wave equations.
5.	Apply Fourier transforms for the given application.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2										2	2		3
	2	3	1										2	2		3
	3	3	1										2	2		3
	4	3	2										2	2		3
	5	3	2										2	2		3

SYLLABUS

UNIT-I VECTOR DIFFERENTIATION 12 Periods

Differentiation of Vectors – Scalar and Vector point function – Del applied to Scalar point functions - Gradient geometrical interpretations – Directional Derivative - Del applied to vector point function – divergence - Curl – Physical interpretation of Divergence and Curl - Del applied twice to point functions- Del applied to product of point functions.

UNIT-II VECTOR INTEGRATION 12 Periods

Integration of vectors – Line integral – Surface – Green‟s theorem in the plane – Stokes theorem – Volume integral – Gauss Divergence theorems (all theorems without proofs) – Irrotational fields .

UNIT-III PARTIAL DIFFERENTIAL EQUATIONS 12 Periods

Introduction – Formation of Partial Differential Equations – Solution of Partial Differential Equations by Direct Integration – Linear Equations of the First order – Higher order Linear

Equations with Constant Co-efficients – Rules for finding the complementary function - Rules for finding the Particular integral – Non- Homogeneous linear equations with constant coefficients.

UNIT –IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12 Periods

Introduction – Method of separation of variables – Vibrations of a stretched string- Wave equation – One dimensional Heat flow - Two dimensional Heat flow – Solution of Laplace‟s equation.- Laplace‟s equation in Polar Co-ordinates.

UNIT-V FOURIER TRANSFORMS 12 Periods

Introduction – definition – Fourier integral theorem - Fourier sine and cosine integrals – Complex form of Fourier integrals – Fourier integral representation of a function – Fourier Transforms – Properties of Fourier Transforms – Convolution Theorem – Parseval‟s identity for Fourier transforms – Fourier Transforms of the Derivatives of functions – Application of Transforms to Boundary value problems – Heat conduction – Vibrations of a string.

Text Books:

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Dehli, 2014.

Reference books:

1. A Text book on Engineering Mathematics by N.P. Bali Etal, Laxmi pub.(p)Ltd , 2001.
2. Advanced Engineering Mathematics by H.K.Dass , S.Chand Publications, 2007.
3. Advanced Engineering Mathematics by Erwin kreyszig, John Wiley Publications, 1999.

ELECTRICAL MACHINES	
ECE 212	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To introduce the concepts of ideal synchronous machines and applications which will be utilized in the electrical machines with its performance and theory of operation.

Course Outcomes:

By the end of the course student should be able to:	
1.	Find efficiency of DC Machine
2.	Find Regulation and Efficiency of Single phase Transformer
3.	Analyze the performance of Induction Motors.
4.	Acquire the knowledge of synchronous machine.
5.	Apply the basic concepts of Electric Power System.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2														2
	2	2														2
	3	2	2													2
	4	1														2
	5	1														2

SYLLABUS

UNIT-I

DC Machines **18 Periods**

Constructional Features, Function of Commutator, Induced EMF and Torque Expressions, Relationship Between Terminal Voltage and Induced EMF for Generator and Motoring Action, Different Types of Excitation and Performance Characteristics of Different Types of DC Machines, Starting and Speed Control of DC Motors, Losses and Efficiency, Efficiency by Direct Loading, Swinburne‟s Test, and Applications of DC Machines.

UNIT -II **12 Periods**

Transformers

Constructional Details, EMF Equation, Equivalent Circuit, Voltage Regulation, Losses and Efficiency, Auto – Transformers, Open/Short – Circuit Tests and Determination of Efficiency and Regulation.

UNIT-III **16 Periods**

Induction Motors

Three-phase Induction Motors Rotating Magnetic Field, Construction of 3-ph Induction Motor, Power Flow Diagram, Torque and Torque-slip Characteristics, Condition for Max. Torque and its Value, Starting methods of 3-phase Induction Motor, Losses and Efficiency,

Efficiency and Torque – Speed Characteristics.

Single-phase Induction Motors: Double Revolving Field Theory, Methods of Starting Single Phase Induction Motors, Stepper Motor.

UNIT-IV **10 Periods**

Three – Phase Synchronous Machines

Generation of EMF, Constructional Details, Induced EMF, Synchronous Generator on No – Load and Load, Synchronous Impedance and Voltage Regulation, Starting of Synchronous Motors, Applications of Synchronous Machines.

UNIT-V **8 Periods**

Electric Energy System (Elementary treatment only)

Single Line Diagram of AC Power supply systems, Types of Power Generation sources(Conventional and Non – Conventional),Power Distribution Systems(Radial and Ring Main Systems).

Text books:

1. J.B. Gupta, "Theory and Performance of Electrical Machines" , S. K. Kataria& Sons, 2009
2. P.S Bimbra, "Electrical Machinery", Khanna Publications, 7th Edition, 2009
3. V.K.Mehta, Rohit Mehta, "Principles of Power System", S. Chand Publications, 4th Edition, 2008

References:

1. Electrical Machines, S. K. Bhattacharya, TMH Publications N. Delhi.

DATA STRUCTURES	
ECE 213	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Objectives:

- To provide the knowledge of basic data structures and their implementations.
- To understand importance of data structures in context of writing efficient programs.

Course Outcomes:

By the end of the course student should be able to:	
1	Demonstrate the knowledge in problem solving techniques.
2	Write programs for different data structures
3	Implement different applications using tree structures.
4	Implement various sorting techniques
5	Apply and implement learned algorithm design techniques and data structures to solve problems using Graphs.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1									2			2
	2	2	1										2			2
	3	1		1									2			2
	4	1		1									2			2
	5	2	2	1									2			2

SYLLABUS

UNIT I

ARRAYS AND STACKS **12-Periods**

Introduction: Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off.

Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Sparse Matrices.

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of Postfix & Prefix expressions using stack, Recursion, Towers Of Hanoi Problem.

UNIT II

QUEUES AND LINKED LIST **12 –Periods**

Queues: Array representation and implementation of queues, Operations on Queue: Insert, Delete, Full and Empty. Circular queue, De-queue, and Priority Queue, Applications of Queues.

Linked list: Representation and Implementation of Singly Linked Lists, Traversing and Searching of Linked List, Insertion and deletion to/from Linked Lists, Doubly linked list, Circular Doubly linked list, Implementing priority queue using Linked List, Polynomial Representation using Linked list & addition.

UNIT III

TREES AND SEARCHING **12-Periods**

Trees: Basic terminology, Binary Trees, Binary tree representation, Almost Complete Binary Tree, Complete Binary Tree, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees.

Searching: Sequential search, binary search, Interpolation Search, comparison and analysis, Hash Table, Hash Functions.

UNIT IV

BINARY SEARCH TREES AND BASIC SORTING TECHNIQUES **12-Periods**

Sorting: Insertion Sort, Bubble Sort, Selection sort, Merge Sort.

Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, AVL Trees.

UNIT V

GRAPHS **10-Periods**

Graphs: Terminology & Representations- Graphs, Directed Graphs, Adjacency Matrices, Path OR Transitive Closure of a Graph, Warshall‟s Algorithm, Shortest path Algorithm-Dijkstra‟s Algorithm, Connected Component and Spanning Trees, Minimum Cost Spanning Trees,Graph Traversals.

Text Books

1. Y. Langsam, M. Augenstin and A. Tannenbaum, “Data Structures using C and C++”, Pearson Education, 2nd Edition, 1995.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education.

References:

1. E.Horowitz and Sahani, "Fundamentals of Data Structures"
2. C Programming and Data structures, P. Padmanabham, 3rd Edition, BS publications..
3. S. Lipschutz, “Data Structures”, McGraw Hill, 1986.
4. Programming in C , P. Dey & M. Ghosh, Oxford Univ. Press.
5. ISRD Group, “Data Structures through C++”, McGraw Hill, 2011.

SIGNALS AND SYSTEMS	
ECE 214	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Engineering Mathematics-I

Course Objectives:

- To introduce concepts of signals and systems in both continuous time and discrete time.
- To learn frequency-domain representation and analysis of signals and systems.

Course Outcomes:

By the end of the course student should be able to:	
1	Identify the type of signals and systems and apply transformations on the independent variable.
2	Characterize the LTI system and find its response for a given input signal.
3	Analyze the continuous time signals and systems in the frequency domain using CTFS, CTFT and Laplace transforms.
4	Analyze the discrete time signals and systems in the frequency domain using DTFT, DFT and Z transforms.
5	Illustrate the Sampling and Reconstruction of low pass and band pass signals using sampling techniques.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1											3	2	
	2	2	2											3	2	
	3	2	2											3	2	
	4	2	2											3	2	
	5	2	1											3	2	

SYLLABUS

Unit- I Introduction to Signals and Systems 10 Periods Continuous-Time (CT) signals and Discrete-Time (DT) signals and their representation, commonly used CT and DT signals: impulse, step, pulse, ramp and exponentials, classification of CT and DT signals: periodic and aperiodic, even and odd, energy signals and power signals, operations on CT and DT signals- addition, subtraction, multiplication, differentiation and integration of CT signals, convolution and correlation of two signals (CT& DT), properties of convolution operation. Time-shifting and time-scaling of CT and DT signals, classification of CT and DT systems: static and dynamic, linear and non-linear, time- invariant and time-varying, basic concepts like causality, stability and invertability of systems.

Unit-II Linear Time-Invariant Systems 10

Periods CT and DT type of LTI systems, impulse response function and unit-sample response sequence, Input-Output relation through convolution summation/ integral, characterization of CT and DT

types of LTI systems, impulse response function/ sequence and causality of LTI systems, interconnectected LTI systems (CT and DT), CT type of LTI systems described by Linear constant coefficient differential equations, DT type LTI systems described by constant coefficient linear difference equations, BIBO stability of LTI systems (CT and DT types).

Unit III Analysis of CT Signals and Systems 12

Periods Fourier series analysis of CT Signals, CT Fourier transform(FT) and its inverse; magnitude and phase spectra, FT using impulses, FT as a particular case of Laplace Transform(LT), FT and LT in CT system analysis, magnitude and phase responses of CT type LTI systems, block diagramrepresentation of Linear Differential Equations with constant coefficients, pole-zero locations, causality (Paley- Wiener Criterion)and stability, distortionless transmission of signals through CT type LTI systems.

Unit IV Analysis of DT Signals and Systems 15

periods Discrete –time Fourier transform(DTFT) & inverse DTFT; convergence of DTFT and IDTFT; DTFT properties and theorems, discrete Fourier transform (DFT)& inverse DFT; properties andtheorems, circular convolution, Z-Transform(ZT) & its properties & theorems, inverse ZT, inversion methods power series, PFE and Residue methods, solution of difference equationsusing ZT, distortionless transmition through DT type of LTI systems, ROCs of right-sided, left sided and finite duration sequences, relationship between ZT, DTFT and DFT.

Application of ZT, DTFT and DFT in DT signal and system analysis, DT system function, transfer function, poles and zeros, stability, block diagram representation of difference equations,processing of CT signals using DFT.

Unit V Sampling of Lowpass and Bandpass Signals 10

periods Lowpass sampling theorem and its proof, types of sampling: impulse sampling, natural samplingand flat-top sampling, spectra of sampled vertions, aliasing, Nyquist rate, anti-aliasing filter, reconstruction of band – limited lowpass signal from its samples, aperture effect due to flat- top sampling, reconstruction filters and zero – order hold(ZOH), sampling of bandpass signals andbandpass sampling theorem.

Text Books :

1. A.V. Oppenheim, AS Willsky and S.H. Nawab: Signals and Systems, Pearson.
2. S.Haykin and B.V Veen: Signals and Systems, John Wiley

References:

1. P. Ramakrishna Rao and Shankar Prakriya : Signals and Systems, second addition, McGrawHill (India) pvt Ltd. 2013
2. NagoorKani: Signals and Systems, McGraw Hill
3. E.W Kamen and B.S.Heck: Fundamentals of Signals and Systems using the Web and Matlab,Pearson.
4. P. Ramesh Babu and R. Anandanatarajan: Signals and Systems 4/e, Scitech.
5. K. Raja Rajeswari and B. Visveswara Rao: Signals and Systems , PHI.

NETWORK ANALYSIS AND SYNTHESIS	
ECE 215	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To make the students capable of analyzing any given electrical network.
- To make the students learn how to synthesize an electrical network from a given impedance/admittance function.

Course Outcomes:

By the end of the course student should be able to:	
1	Apply basic network theorems and analyze both D.C and A.C. circuits.
2	Determine various parameters of two port networks.
3	Analyze circuits under resonant condition.
4	Calculate natural and forced response of RL, RC & RLC circuits
5	Measure real, reactive, apparent power in three phase circuits.

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1	1										3	1	
	2	3	1	2										1	1	
	3	2	2	2										3	2	2
	4	3	1	2										1		1
	5	2	2	3										2	1	2

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

SYLLABUS

UNIT-I

ANALYSISOFDCCIRCUITS **10 periods**

Active Element, PassiveElement,Reference Directions For Current and Voltage, Kirchoff‟s Laws, Voltage and Current Division, Nodal Analysis, Mesh Analysis, Linearity and Superposition, Thevenin's and Norton‟s Theorems, Source Transformation.

UNIT-II

DC TRANSIENTS **12 periods**

Inductor, Capacitor, Source Free RL, RC &RLC Response,Evaluation of initial Conditions, Application of Unit-Step Function to RL,RC &RLC Circuits, Concepts of Natural, Forced and Complete Response.

UNIT-III

SINUSOIDALSTEADY-STATEANALYSIS **14 periods**

The Sinusoidal Forcing Function, Phasor, Instantaneous and Average Power, Complex Power, Steady State Analysis Using Meshand Nodal An alysis, Application of Network Theorems to A.C. Circuits.

UNIT-IV
RESONANCE &COUPLEDCIRCUITS **12periods**

Balanced Three Phase Circuits, Resonance, Concept of Duality. Coupled Circuits: Magnetically Coupled Circuits, Dot Convention.

UNIT-V
NETWORK SYNTHESIS **10 periods**

Elementary synthesis operation, LC network synthesis, Properties of RC network functions, Foster and Cauer forms of RC and RL networks.

Textbooks:

1. W.H. HAYT Jr & J.E. KEMMERLY, "ENGINEERING CIRCUIT ANALYSIS, 5th Edition, Mc. Graw Hill Pub.
2. M.E. VAN VALEKNBURG, "NETWORK ANALYSIS", 3rd Edition, PHI Learning.

Reference book:

1. Circuits and Networks by A. Sudhakar Shyammohan S Palli, 4th Edition, TMH Publication.

ELECTRONIC CIRCUITS AND ANALYSIS-I	
ECE 216	**Credits:4**
Instruction: 4 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To provide knowledge of the basic principles of electronic circuits operation.
- To calculate and measure parameters for electronic circuits,
- To design and analyze the performance of electronic circuits.

Course Outcomes:

By the end of the course student should be able to:	
1	Analyze circuits that contain bipolar transistors, resistors and dc sources using appropriate models at low and high frequencies.
2	Analyze the frequency response characteristics of single stage and multistage amplifier circuits and different circuit configurations for improving the transistor amplifier characteristics such as input impedance, voltage gain etc.
3	Analyze the response of linear wave shaping circuits such as high pass and low pass filter circuits for different types of inputs such as step input, pulse input, square input ramp input.
4	Analyze the response of Non-linear wave shaping circuits such as clipping and clamping circuits when the sinusoidal input is applied.
5	Analyze various multivibrators to meet the given specifications.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

SYLLABUS

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2													2
	2	3	2													2
	3	3	2													1
	4	3	2													1
	5	3	2													2

Unit-I

Transistor at low frequencies and high frequencies 12 periods

Graphical analysis of CE configuration, Two port devices and hybrid model, Transistor hybrid model, h-parameters, conversion formulas of three transistor configurations, Analysis oftransistor amplifier circuit using h-parameters, the emitter follower, Millers theorem and its dual, cascading transistor amplifiers, simplified CE hybrid model, high input resistance transistor circuits, hybrid- π CE transistor model, hybrid- π conductance, hybrid- π capacitances, validityand variation of hybrid- π parameters.

Unit-II

Multistage Amplifiers 8 periods

Classification of amplifiers, Distortion in amplifiers, Frequency response of an amplifier, TheRC coupled amplifier-low frequency response, high frequency response of two cascaded CE stages, Band- pass of cascaded stages, Cascode amplifiers, Multistage CE amplifier cascade at High frequencies.

Unit-III

Linear wave shaping **12 periods**

The high pass RC circuit, High pass RC circuit as a differentiator, Double differentiation, The low pass RC circuit, Low pass RC circuit as an integrator, attenuators, RL and RLC circuits.

Unit-IV

Clipping and Clamping Circuits **12 periods**

Diode Clippers, The transistor clipper, Clipping at two independent levels, Cathode coupled and emitter coupled clipper, Compensation for temperature changes, comparators, breakaway diode and amplifier, diode differentiator comparator, accurate time delays, applications of voltage comparator, The clamping operation, clamping circuit taking source and diode resistance into account, Clamping circuit theorem, Practical clamping circuits, effect of diode characteristics on clamping voltage, Synchronized clamping.

Unit-V

Multivibrators **12 periods**

Stable stages of a binary, fixed bias transistor binary, self bias transistor binary, commutating capacitors, methods of improving resolution, emitter coupled binary, Schmitt trigger circuit, the monostable multivibrator, emitter coupled monostable multivibrator, astable emitter coupled multivibrator.

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.[unit1,unit2]
2. Jacob Millman & Herbert Taub, “Pulse Digital & Switching Waveforms” McGraw-Hill Book Company Inc.[unit3,unit4,unit5]

References:

1. Donald A. Neamon, “Electronic Circuit Analysis and Design”, 2nd Edition. TMH publications.

ELECTRONIC CIRCUITS AND ANALYSIS-I LABORATORY	
ECE 217	**Credits:2**
Instruction: 3 Practical‟s / Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites: Nil

Course Objectives:

- To design and analyze PN junction diodes, rectifiers, BJT amplifiers, linear wave shaping and nonlinear wave shaping circuits, clipping and clamping circuits, multi-vibrators etc.

Course Outcomes:

By the end of the course student should be able to:	
1	Measure the important parameters of a PN diode from the V-I characteristics.
2	Find the ripple factor for the given rectifier circuit
3	Design amplifier circuits using BJTs in different configurations and determine fL and fH from the frequency response characteristics.
4	Design linear wave shaping circuits and non linear wave shaping circuits.
5	Design different multivibrator circuits.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

LIST OF EXPERIMENTS

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1			3				1	1	1					1
	2	2			3				1	1	1					2
	3	2		2	3				1	1	1					2
	4	2		2	3				1	1	1					1
	5	2		2	3				1	1	1					2

Cycle-I Design and simulation using MultiSim software

1. Plot the V-I characteristics of a PN diode in forward and reverse bias and find the static,dynamic resistances and the reverse saturation current.
2. Plot the V-I characteristics and regulation characteristics of a Zener diode in reverse bias.
3. Plot the output waveforms of a halfwave rectifier and find the ripple factor.
4. Plot the output waveforms of a fullwave rectifier using 2 diodes.
5. Plot the output waveforms of a Bridge rectifier and find the ripple factor.
6. Low pass and High pass circuits
7. Clippers and Clampers circuit
8. Plot the input and output characteristics of CE configured transistor and to find the h-parameter values from the characteristics.
9. Plot the input and output characteristics of CB configured transistor and to find the h-parameter values from the characteristics.
10. Plot the input and output characteristics of CC configured transistor and to find the h-parameter values from the characteristics.
11. Plot the drain and transfer characteristics of a JFET.
12. Plot the frequency response of a single stage CE amplifier.

13. Plot the frequency response of a single stage CC amplifier.

14. Verify the working of a BJT as a switch.
15. Frequency Response of a RC coupled multistage amplifier
16. Study the operation of a Bistable multivibrator and observe the switching action.
17. Astable Multivibrator
18. Monostable Multivibrator
19. Observe the hysteresis loop of a Schmitt trigger circuit
20. Design and implement a DC regulated power supply.

Cycle-II (Hardware experiments)

1. Plot the V-I characteristics of a PN diode in forward and reverse bias and find the static,dynamic resistances and the reverse saturation current.
2. Plot the V-I characteristics and regulation characteristics of a Zener diode in reverse bias.
3. Plot the output waveforms of a halfwave rectifier and find the ripple factor.
4. Plot the output waveforms of a fullwave rectifier using 2 diodes.
5. Plot the output waveforms of a Bridge rectifier and find the ripple factor.
6. Plot the input and output characteristics of CE configured transistor and to find the h-parameter values from the characteristics.
7. Plot the input and output characteristics of CB configured transistor and to find the h-parameter values from the characteristics.
8. Plot the drain and transfer characteristics of a JFET.
9. Verify the working of a BJT as a switch.
10. Plot the frequency response of a single stage CE amplifier.
11. Plot the frequency response of a single stage CC amplifier.
12. Study the operation of a Bistable multivibrator and observe the switching action.
13. Observe the hysteresis loop of a Schmitt trigger circuit

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition,McGraw Hill Publication, 2009.
2. Jacob Millman & Herbert Taub, “Pulse Digital & Switching Waveforms” McGraw-HillBook Company Inc.

References:

1. Donald A. Neamon, “Electronic Circuit Analysis and Design”, 2nd Edition. TMHpublications.

NETWORK & EM LABORATORY	
ECE 218	**Credits:2**
Instruction: 3 Practical‟s / Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites: Nil

Course Objectives:

- To understand the application of basic network theorems
- To understand the characteristics of DC machines and single-phase transformers and regulation of an alternator.

Course outcomes:

By the end of the course student should be able to:	
1	Conduct the experiments based on basic network theorems.
2	Predict the characteristics of D.C machines and single phase transformers
3	Predict the regulation of an alternator.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1	1	3		1							3		2
	2	3	2		3		2							2	1	1
	3	2	1	1	3		1							2	1	1

LIST OF EXPERIMENTS

CYCLE-I: Networks Lab

1. To obtain filament lamp characteristics.
2. Verification of KCL & KVL.
3. Verification of superposition theorem.
4. Verification of Thevenin‟s and Norton‟s theorem.
5. Determination of two port network parameters.

CYCLE-II: Electrical Machines Lab

1. O.C.C & Load characteristics of D.C shunt generator.
2. Swinburne‟s test on D.C. shunt machine.
3. Brake test on D.C. shunt motor.
4. O.C. & S.C test on a single phase transformer.
5. Brake test on 3-phase induction motor.
6. Regulation of alternator by e.m.f. method.

Textbooks:

1. W.H.Haytjr&J.E.Kemmerly , “Engineering Circuit Analysis” , 5th Edition, Mc. Graw HillPub.
2. J.B. Gupta, “Theory and Performance of Electrical Machines” ,S. K. Kataria& Sons, 2009

ENGINEERING MATHEMATICS –IV	
ECE 221	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To develop mathematical skill so that students are able to apply mathematical methods & principles in solving problem from engineering fields.

Course Outcomes:

By the end of the course student should be able to:	
1	Apply the concepts of Analytic function, harmonic function, Taylor and Laurent Seri Singularity, Residues and evaluation of improper integrals.
2	Apply the concepts of Finite Differences and Interpolation techniques.
3	Apply the concept of Differentiation and Integration by numerical methods.
4	Apply the characteristics and properties of Z-transforms for solving the given problem.
5	Analyze the Statistical data by using statistical tests and to draw valid inferences about the population parameters.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1											2		1
	2	2	1											2		1
	3	2	1											2		1
	4	2	1											2		1
	5	2	1											2		1

SYLLABUS

UNIT-I FUNCTIONS OF A COMPLEX VARIABLE 14 Periods

Introduction –Limit of a Complex function- Derivative of (z) – Analytic functions-Harmonic functions - Applications to Flow problems. Complex Integration- Cauchy‟s Theorem- Cauchy‟s Integral Formula –Series of Complex terms (Statements of Taylor‟s and Laurent‟s Series without proof) - Zeros of an Analytic function - Residues - Calculation of Residues - Evaluation of Real Definite Integrals (Integration around the unit circle, Integration around the small semi circle , Indenting the Contours having poles on the real axis).

Geometric representation of (z), Some standard transformation

($= z + c, w = cz$, $w = \frac{1}{z}$, $w = \frac{az+b}{cz+d}$) .

UNIT-II FINITE DIFFERENCES & INTERPOLATION 12 Periods

Finite Differences – Forward differences – Backward differences – Central differences – Differences of a Polynomial – Factorial Notation – Other difference operators – To find one or more missing terms – Newton‟s Interpolation Formulae – Central Difference Interpolation Formulae - Interpolation with Unequal Intervals – Lagrange‟s interpolation formula – Inverse Interpolation.

UNIT-III NUMERICAL DIFFERENTIATION AND INTEGRATION 10 Periods

Numerical Differentiation – Formulae for derivatives – Maxima and Minima of a Tabulated Function – Numerical Integration – Newton-Cotes Quadrature Formula – Trapezoidal rule – Simpson‟s One-Third rule , Simpson‟s Three-Eighth rule.

UNIT - IV Z – TRANSFORMS 12 Periods

Introduction – Definition - Some Standard Z-Transforms –Linearity Property –Damping Rule – Some Standard Results - Shifting U_n to the right , Shifting U_n to the left – Two basic theorems (Initial Value Theorem and Final Value Theorem) – Convolution Theorem – Convergence of Z-transforms – Two sided Z - transform of U_n - Evaluation of inverse Z- transforms (Power Series Method , Partial Fraction Method , Inverse integral method) - Applications to Difference equations.

UNIT-V SAMPLING THEORY 12 Periods

Introduction – Sampling Distribution – Testing a hypothesis – Level of Significance – Confidence Limits – Test of Significance of Large samples (Test of significance of single mean, difference of means) – Confidence limits for unknown – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – Chi-Square (χ^2) Test – Goodness of fit.

Text Books:

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Dehli, 2014.

Reference books:

1. N.P. Bali Etal, “A Text book on Engineering Mathematics”, Laxmi pub.(p) Ltd , 2011.
2. H.K.Dass “Advanced Engineering Mathematics”, S.Chand Publications, 2007.
3. Erwin kreyszig, “Advanced Engineering Mathematics”, John Wiley Publications, 1999.

ELECTRONIC CIRCUITS AND ANALYSIS-II	
ECE 222	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: ECA-I

Course Objectives:

- To understand the design and working of BJT / FET amplifiers, oscillators and Operational Amplifiers.
- To design and analyze the performance of electronic circuits.

Course Outcomes:

By the end of the course student should be able to:	
1	Analyze and Design negative feedback amplifiers and sinusoidal oscillator circuits
2	Analyze and Design various power amplifiers and tuned voltage amplifiers.
3	Analyze and Design differential amplifier circuits and current mirror circuits using BJTs.
4	Analyze and Design analog circuits like integrator, differentiator, comparator, instrumentation amplifier and logarithmic amplifier using op-amps.
5	Analyze amplifier circuits containing MOS transistors, resistors and dc sources.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	2												2
	2	3	2	2												2
	3	3	2	2												2
	4	3	2	2									1			2
	5	3	2													2

SYLLABUS

Unit-I

Feedback Amplifiers **14 Periods**

Classification of amplifiers, the feedback concept, general characteristics of negative feedback, effect of negative feedback on input and output impedance, Method of analysis of feedback amplifiers,

Oscillators

Sinusoidal oscillators, Phase shift oscillators, Resonant circuit oscillators, General form ofoscillator circuit, The wien bridge oscillator, crystal oscillators, Frequency stability.

Unit-II

Tuned voltage amplifiers **10 Periods**

Introduction, need for tuned voltage amplifiers, operation of single tuned, double tuned and stagger tuned amplifiers.

Power Amplifiers

Class A Large Signal amplifiers, Second Harmonic Distortion, Higher order Harmonic Distortion, The Transformer coupled audio power amplifier, Efficiency, Push-Pull amplifiers, Class B Amplifiers, Class AB operation, Class C amplifier.

Unit-III

Differential amplifiers **10 Periods**

The Differential amplifier, Basic BJT differential pair, DC transfer characteristic, small signal equivalent circuit analysis, differential and common mode gain, differential and common mode impedances, Bipolar transistor current sources, two transistor current sources, improved current source circuits, Widlar current source, multi transistor current mirrors.

Unit-IV

Applications of Operational Amplifiers: 10 Periods Review of basics of Op-Amp, Basic op-amp applications, Differential DC amplifier, Stable ACcoupled amplifier, Analog Integration and differentiation, comparators, sample and hold circuits,Precision AC/DC converters, Logarithmic amplifiers, waveform generators, regenerativecomparators, Instrumentation amplifier.

Unit-V

FET Amplifiers **12 Periods**

MOSFET DC circuit analysis, The MOSFET amplifier - small signal equivalent circuit, Common source amplifier, source follower amplifier, Common Gate amplifier. NMOS amplifiers with enhancement load, depletion load and PMOS load, CMOS source follower and common gate amplifiers.

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition,McGraw Hill Publication, 2009.[unit-1,unit-2,unit-4]
2. Donald A. Neamon, “Electronic Circuit Analysis and Design”, 2nd Edition. TMGpublications. [unit-3,unit-5]

References:

1. Ramakanth A Gayakwad, “Op-Amps and Linear Integrated Circuits”- 4th Edition.

DIGITAL ELECTRONICS	
ECE 223	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To prepare students to perform the analysis and design of combinational and sequential logic circuits.

Course Outcomes:

By the end of the course student should be able to:	
1	Perform number conversions between different number systems and codes and apply Boolean algebra to minimize logic expressions up to three variables.
2	Analyze the characteristics of logic families and compare their performance in terms of performance metrics.
3	Apply simplification methods such as Map method(upto four variables), VEM method (upto four variables) and tabulation method(upto five variables) to minimize logic expressions and design a combination logic circuits like decoders, encoders, multiplexers, and de-multiplexers etc. for a given specification..
4	Analyze and Design the synchronous sequential circuits.
5	Analyze and Design Asynchronous sequential circuits.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	1	1												1
	2	1	2	2												1
	3	2	2	2												2
	4	2	2	2									1			2
	5	2	2	2									1			2

SYLLABUS

UNIT-I **10 periods**

NUMBER SYSTEMS: Number representation, Conversion of bases, Binary Arithmetic, Representation of Negative numbers, Binary codes: weighted and non-weighted, Error detecting and correcting codes -- Hamming codes.

BOOLEAN ALGEBRA: Basic definitions, Axiomatic Definitions, Theorems and properties, Boolean Functions, Canonical and standard forms.

UNIT-II **10 periods**

LOGIC FAMILIES

Binary Logic, AND, OR, NOT, NAND, NOR, EX-OR and Equivalence gates.

Introduction, Specifications of digital circuits, RTL and DTL circuits, Transistor-Transistor Logic (TTL), Emitter Coupled Logic (ECL), MOS, CMOS circuits, Performance comparison of logic families.

UNIT-III **14 periods**

GATE-LEVEL MINIMIZATION

The Map Method: Two variable map, Three variable map, four variable map, Prime Implicants, Don't care conditions, NAND and NOR implementation, Exclusive-OR Function, Parity Generation and Checking, Variable Entered Mapping (VEM): Plotting Theory, Reading Theory, Quine-Mccluskey (QM) Technique.

COMBINATIONAL LOGIC

Combinational circuits, Analysis Procedure, Design procedure, Binary Adder-Subtractor, Decimal adder, carry look ahead adder, Binary Multiplier, Magnitude comparator, Decoders, Encoders, Multiplexers, ROM, PLA, PAL.

UNIT-IV **14 periods**

SYNCHRONOUS SEQUENTIAL LOGIC

Block diagram of sequential circuit, Latches, Flip-flops, Triggering of Flip-flops, Flip-flop excitation tables, Analysis of clocked sequential circuits, State equations, state table, state diagram, analysis with D, JK and T-Flip-flops, state machines, state reduction and assignment, Design procedure.

REGISTERS AND COUNTERS

Registers, Shift registers, universal shift register Ripple counters, Synchronous counters, counter with unused states, Ring counters, Johnson counter.

UNIT-V **12 periods**

ASYNCHRONOUS SEQUENTIAL LOGIC

Analysis Procedure, Circuits with latches, Design procedure, Reduction of state and flow tables, cycles, Race-Free state Assignment, Hazards, Design example.

Text Books:

1. M. Morris Mano, Digital Design, 3rd Edition, Pearson Publishers, 2001.
2. Z Kohavi, Switching and Finite Automata Theory, 2nd edition, TMH, 1978

Reference Books:

1. William I. Fletcher, An Engineering Approach to Digital Design, PHI, 1980.
2. John F. Wakerly, Digital Design Principles and Practices, 3rd Edition, Prentice Hall, 1999.
3. Charles H Roth Jr and Larry L. Kinney, Fundamentals of Logic Design, Cengage learning,7th Edition, 2013
4. R.P Jain, Modern Digital Electronics, 3rd Edition, TMH, 2003.

PROBABILITY THEORY AND RANDOM PROCESSES	
ECE 224	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Signals and systems

Course Objectives:

- To understand the fundamentals of Probability Theory, concept of random variables, probability density and distribution functions.
- To know some important operations to perform on a random variable / multiple random variables.
- To understand the mathematical concepts and analysis of random processes with its basic applications to the signal processing in the communication system.

Course Outcomes:

By the end of the course student should be able to:	
1	Calculate probabilities and conditional probabilities of events defined on a sample space.
2	Compute statistical averages of one random variables using probability density and distribution functions and also transform random variables from one density to another
3	Compute statistical averages of two or more random variables using probability density and distribution functions and also perform multiple transformations of multiple random variables.
4	Determine stationarity and ergodicity and compute correlation and covariance of a random process.
5	Compute and sketch the power spectrum of the response of a linear time-invariant system excited by a band pass/band-limited random process.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2												2	
	2	3	2												2	
	3	3	2										1		2	
	4	3	2											1	2	
	5	3	2										1	1	2	

SYLLABUS

UNIT-I Probability and Random Variable **12Periods**

Probability:

Probability introduced through Sets and Relative Frequency, Experiments andSample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, JointProbability, Conditional Probability, Total Probability, Bayes‟ Theorem, Independent Events.

Random Variable: Definition of a Random Variable, Conditions for a Function to be a RandomVariable, Discrete, Continuous and Mixed Random Variables.

UNIT –II Distribution & Density Functions and Operation on One Random Variable 12 Periods

Distribution & Density Functions: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, and Properties.

Operation on One Random Variable: 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, Transformation of aDiscrete Random Variable.

UNIT-III Multiple Random Variables and Operation 12 Periods

Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Propertiesof Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density –Point Conditioning, Conditional Distribution and Density – Interval conditioning, StatisticalIndependence, Sum of Two Random Variables, Sum of Several Random Variables, CentralLimit Theorem (Proof not expected), Unequal Distribution, Equal Distributions.

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT-IV Random Process - Temporal Characteristics 12 periods

Introduction, The Random Process Concept: Classification of Process, Deterministic and Nondeterministic Process. Stationary and Independence: Distributions and Density Functions, Statistical Independence, First-order Stationary Process, Second-Order and Wide-sense Stationary, N-Order and Strict-Sense Stationary, Time Averages and Ergodicity, Mean-Ergodic Process, Correlation-Ergodic Process. Correlation Functions: Autocorrelation Functions and Its Properties, Cross-correlation Functions and its properties, Covariance Functions, Discrete-Time Process and Sequences. Measurement of Correlation Functions, Guassian Random Process, Poisson Random Process, Complex Random Process.

UNIT-V Spectral Analysis 12 periods

The Power Spectrum, Linear System, Hilbert Transform, Discrete Time Process, Modulation: Rice‟s Representation, Band pass processes, Band limited Processes and Sampling Theory.

Text Book:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, 4Ed., 2001,McGraw Hill.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S.Unnikrishna Pillai, McGraw Hill, 4th Edition, 2002.

Reference Book:

1. Probability Theory and Random Processes, S. P. Eugene Xavier, S. Chand and Co. NewDelhi, 1998 (2nd Edition).
2. Probability, Statistics, and Random Processes for Engineers- Henry Stark & John W.

Woods,4Ed, 2012, Pearson
3. Introduction to Random Signals and Noise, Davenport W. B. Jrs. and W. I. Root, McGrawHill N.Y., 1954.

ELECTROMAGNETIC FIELD THEORY & TRANSMISSION LINES	
ECE 225	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: EM-I, EM-II

Course Objectives:

- To provide the basic skills required to understand, develop, and design various engineering applications involving electromagnetic fields.
- To lay the foundations of electromagnetism and its practice in modern communications such as wireless, guided wave principles such as fiber optics and electronic electromagnetic structures.

Course Outcomes:

By the end of the course student should be able to:	
1	Apply vector calculus and laws of physics to solve the problems of electrostatic fields.
2	Apply magnetostatic laws to solve the problems related to magnetostatic fields.
3	Analyze time varying fields using Maxwell‟s equations in differential and integral forms.
4	Analyze the phenomenon of Electromagnetic waves in conducting and dielectric medium.
5	Design stubs using smith charts based on the concepts of transmission lines.

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	1											3	
	2	3	2	1											3	
	3	3	2	1											3	
	4	3	2	1											3	
	5	3	2	3											3	

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

SYLLABUS

UNIT I Electrostatics **14 periods**

Introduction to vector analysis, Fundamental of electrostatic fields, Different types of charge distributions, Coulomb‟s law and Electric field intensity**,** Potential function, Equi-potential surface, Electric field due to dipole; Electric flux density, Gauss‟s law and applications, Poisson‟s and Laplace‟s equations and its applications; Uniqueness theorem; Boundary conditions; Conductors & Dielectric materials in electric field; Current and current density, Relaxation time, Relation between current density and volume charge density; Dipole moment, Polarization, Capacitance, Energy density in an electric field.

UNIT II Steady Magnetic Fields **12 periods**

Introduction, Faradays law of induction, Magnetic flux density, Biot-Savart law, Ampere‟s circuit law, Magnetic Force, Magnetic Boundary conditions, Scalar and Vector magnetic potentials, Magnetization & Permeability in materials, Inductance, Energy density, Energy storedin inductor.

UNIT III Maxwell's Equations **10 periods**

Introduction, Faradays law, displacement current, Equation of continuity for the varying fields, inconsistency of Amperes circuit law, Maxwell‟s equations in integral form, Maxwell‟s equations in point form, retarded potentials Meaning of Maxwell‟s equations, conditions at a Boundary surfaces, Retarded potentials.

UNIT IV Electromagnetic Waves **10 periods**

Introduction, Applications of EM waves, solutions for free space condition ,; Uniform plane wave propagations uniform plane waves, wave equations conducting medium, sinusoidal time variations, conductors & dielectrics, Depth of penetration, Direct cosines, Polarization of a wave, reflection by a perfect conductor – Normal incidence, Oblique incidence, reflection by a perfect dielectric-Normal incidence, reflection by a perfect insulator – oblique, Surface impedance, Poynting vector and flow of power, Complex poynting vector.

UNIT V Transmission Lines **10 periods**

Types of transmission lines, Applications of transmission lines, Equivalent circuit of pair of transmission lines, Primary constants, Transmission line equations, Secondary constants, lossless transmission lines, Distortionless line, Phase and group velocities, Loading of lines, Input impedance of transmission lines, RF lines, Relation between reflection coefficient, Load and characteristic impedance, Relation between reflection coefficient and voltage standing wave ratio (VSWR), Lines of different lengths - $\lambda/8, \lambda/4, \lambda/2$ lines, Losses in transmission lines, Smith chart and applications, Stubs, Double stubs.

Text Books:

1. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2nd Ed., 2000.

2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", TMH, 7th Ed., 2006.

Reference Books:

1. G.S.N.Raju, Electromagnetic Field Theory And Transmission Lines, Pearson Education (Singapore) Pvt., Ltd., New Delhi, 2005.
2. M.N.O. Sadiku, " Principles of Electromagnetics", Oxford International Student edn., 4thedn., 2007.
3. G. SasiBhushana Rao, "Electromagnetic Field Theory andTransmission Lines", Wiley, India Pvt. Ltd, 2012.
4. Simon Ramo, et.al-, "Fields and waves in communication electronics", Wiley India Edn., 3rdEdn., 1994

CONTROL SYSTEMS	
ECE 226	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: signals and systems

Course Objectives:

- To understand concepts of the mathematical modeling, feedback control and stability analysis in time and frequency domains.

Course Outcomes:

By the end of the course student should be able to:	
1	Apply block reduction techniques and signal flow graphs
2	Apply mathematical modelling of mechanical and electrical systems
3	Analyze the given systems in time domain
4	Determine the relative and steady state stability of the systems
5	Analyze the systems in frequency domain

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1														2
	2	1														2
	3	2	1											1		2
	4	2	1											1		2
	5	2	2											1		2

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

SYLLABUS

UNIT-II Introduction to Control Systems **12 Periods** Transfer Functions of Linear Systems –Impulse Response of Linear Systems-Block Diagrams of Control Systems-Signal Flowgraphs (Simple Problems) - ReductionTechniques for Complex Block Diagrams and Signal FlowGraphs (Simple Examples).

UNIT-II Modeling of Control Systems **10 periods** Introduction to Mathematical Modelling of Physical Systems - Equations of Electrical Networks –Modelling of Mechanical Systems - Equations of Mechanical Systems.

UNIT-III Time domain analysis **16 periods**
Time Domain Analysis of Control Systems –Time Response of First and Second Order Systems with Standard Input Signals-Steady State Performance of Feedback Control Systems- Steady State Error Constants-Effect of Derivative and Integral Control on Transient and Steady state Performance of Feedback Control Systems.

UNIT-IV Concept of stability in time domain **12**

periods Concept of Stability and Necessary Conditions for Stability - Routh - Hurwitz Criterion, Relative Stability Analysis, The Concept and Construction of Root Loci, Analysis of Control Systems With Root Locus (Simple Problems to Understand Theory)

UNIT-V Frequency domain analysis **14**

periods Correlation Between Time and Frequency Responses - Polar Plots - Bode Plots - Log Magnitude Versus Phase Plots-All Pass and Minimum Phase Systems-Nyquist StabilityCriterion-Assessment of Relative Stability-Constant M&N Circles.

Textbooks:

1. I.J.Nagrath&M.Gopal, "Control systems engineering", wiley eastern limited.
2. BenjaminC.Kuo, "Automaticcontrolsystems", prenticehallofIndia

References:

1. Ogata, "Moderncontrolengineering", prenticehallofIndia.

ELECTRONIC CIRCUITS AND ANALYSIS-II LABORATORY	
ECE 227	**Credits:2**
Instruction: 3 Practicals /Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites: ECA-I

Course Objectives:

- The objective of this lab is to correlate the theoretical concepts of different analog electronic circuits with practical feasibility thereby giving them a scope to learn basic electronic circuits and their different electrical characteristics in a better way.

Course outcomes:

By the end of the course student should be able to:	
1	Analyze and Design feedback amplifiers and sinusoidal oscillator circuits.
2	Analyze and Design various power amplifiers and tuned voltage amplifiers.
3	Calculate the parameters of differential amplifier using BJTs or Op-amp
4	Analyze and Design amplifier circuits using op-amps.
5	Analyze and Design various application circuits using op-amp such as summing amplifier, integrator, differentiator etc

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	2	2				1	1	1					2
	2	2	2	2	2				1	1	1					2
	3	2	2	2	2				1	1	1					2
	4	2	2	2	2				1	1	1					2
	5	2	2	2	2				1	1	1					2

LIST OF EXPERIMENTS

1. Obtain the input and output impedance of a trans-conductance amplifier with and without feedback.
2. Obtain the frequency response of a voltage shunt negative feedback amplifier with and without feedback.
3. Generate a sinusoidal signal using Colpitts oscillator at a desired frequency.
4. Generate a sinusoidal signal using Wein bridge circuit.
5. Generate a sinusoidal signal using RC phase shift oscillator and observe the Lissajous patterns at different phase shifts.
6. Plot the frequency response of a tuned voltage amplifier and find the resonant frequency.
7. Obtain the output waveforms of a class-B push pull power amplifier and calculate the efficiency and distortion.
8. Obtain the output waveforms of a class-A transformer coupled power amplifier and calculate the power conversion efficiency.
9. Determine the gain and CMRR for the BJT differential amplifier.
10. Obtain the signals at the output junctions of multistage BJT differential pair.
11. Verify different applications of an Operational amplifier.
12. Verify different parameters of an operational amplifier.
13. Observe the working of an operational amplifier in inverting, non inverting and differential

modes.

14. Plot the V-I characteristics of an n-channel enhancement MOSFET and verify its operation as an inverter.
15. Verify the working of a CMOS source follower amplifier.

Text books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. Donald A. Neamon, “Electronic Circuit Analysis and Design”, 2nd Edition. TMG publications.

References:

1. Ramakanth A Gayakwad, “Op-Amps and Linear Integrated Circuits”- 4th Edition.

SIMULATION LABORATORY	
ECE 228	**Credits:2**
Instruction: 3 Practicals /Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites: Signals and systems, Digital Electronics

Course Objectives:

- To understand the basic operation on signals and systems
- To understand and verify the operation of different types of digital circuits
- To familiarize with MATLAB/Modelsim Tools.

Course outcomes:

By the end of the course student should be able to:	
1	Determine the convolution and correlation of signals using MATLAB
2	Verify the time invariance and linearity property of a given system using MATLAB.
3	Plot the magnitude and phase spectrum of a given signal using various transformation tools in MATLAB.
4	Modeling, simulation, functional verification of combinational logic circuits Using Xilinx tools in VHDL.
5	Modeling, simulation, functional verification of sequential logic circuits Using Xilinx tools in VHDL.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1		2	2			1	1	1			2		
	2	2	1		2	2			1	1	1			2		
	3	2	1		2	2			1	1	1			2		
	4	2	1	2	2	2			1	1	1					2
	5	2	1	2	2	2			1	1	1					2

LIST OF EXPERIMENTS

Cycle-I (MATLAB)

1	Basic Operations on Matrices.
2	Write a program for Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc.
3	Write a program to perform operations like addition, multiplication, scaling, shifting, and folding on signals and sequences and computation of energy and average power.
4	Write a program for finding the even and odd parts of signal/ sequence and real and imaginary parts of signal.
5	Write a program to perform convolution between signals and sequences.
6	Write a program to perform autocorrelation and cross correlation between signals and sequences.
7	Write a program for verification of linearity and time invariance properties of a given continuous/discrete system
8	Write a program for computation of unit samples, unit step and sinusoidal response of the given LTI system and verifying its physical realiazability and stability properties.
9	Write a program to find the Fourier transform of a given signal and plotting its magnitude and Phase spectrum.

10	Write a program for locating the zeros and poles and plotting the pole-zero maps in S plane and Z-plane for the given transfer function.
11	Write a program for Sampling theorem verification.

Cycle-II (VHDL modeling and simulation of the following experiments using ModelSim)

1.	Write VHDL code for basic gates
2.	Write a VHDL code to describe the functions of Half adder & Full Adder
3.	Write a VHDL code to describe the functions of Half Subtractor and Full Subtractor
4.	Write a VHDL code to describe the functions of 4:1 & 8:1 Multiplexer
5.	Write a VHDL code to describe the functions of 1:4m &1:8 Demultiplexer
6.	Write VHDL code to describe the functions of 3:8 decoder & 8:3 priority encoders.
7.	Write VHDL code to describe the functions of SR-Flipflop, D-FlipFlop & JK-FlipFlop
8.	Design of 4 Bit Binary to Gray code Converter
9.	Write VHDL for Serial for simulating SISO & PISO shift registers
10.	Write a program to design a 4bit Up-counter

Note: A minimum of any ten experiments have to be done from cycle-I and any six experiments from cycle-II

Text Books:

1. Rudra Pratap, "Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers " Oxford 2010.
2. J Bhaskar,"VHDL Primer"3rd Edition ,Prentice Hall 1999

References:

1. J G Proakis, VK Ingle, "Digital signal processing using MATLAB", 3rd Edition, Cengage learning.

THIRD YEAR SYLLABI

I - Semester

&

II - Semester

ThirdYearI–Semester

CODE	SUBJECT NAME	Category	Instruction periods per Week				MAX MARKS		CREDITS
			LECTURE	TUTORIAL	PRACTICAL	TOTAL	SESSIONAL MARKS	SEMESTER END MARKS	
ECE 311	Open Elective- I	OE	3	1	-	4	40	60	3
ECE 312	Communication Systems Engineering	PC	4	1	-	5	40	60	4
ECE 313	Microprocessors and Applications	PC	3	1	-	4	40	60	3
ECE 314	Computer Architecture & Organization	ES	3	1	-	4	40	60	3
ECE 315	Integrated circuits and Applications	PC	3	1	-	4	40	60	3
ECE 316	Antennas & Wave Propagation	PC	3	1	-	4	40	60	3
ECE 317	Microprocessors & Applications Laboratory	PC	-	-	3	3	50	50	2
ECE 318	IC Laboratory	PC	-	-	3	3	50	50	2
ECE 319	Quantitative Aptitude & Verbal Aptitude-I	HS	4	-	-	4	100	-	2
Total			23	6	6	35	440	460	25

OpenElective-I:(forECE,offered by otherdepartments) Refer Annexure-I

ThirdYearII–Semester

CODE	SUBJECT NAME	Category	Instruction periods per Week				MAX MARKS		CREDITS
			LECTURE	TUTORIAL	PRACTICAL	TOTAL	SESSIONAL MARKS	SEMESTER END MARKS	
ECE 321	Microwave & Radar Engineering	PC	3	1	-	4	40	60	3
ECE 322	Digital Signal Processing	PC	4	1	-	5	40	60	4
ECE 323	Microcontrollers & Embedded Systems	PC	3	1	-	4	40	60	3
ECE 324	Professional Elective-I	PE	3	1	-	4	40	60	3
ECE 325	Digital Communications	PC	3	1	-	4	40	60	3
ECE 326	Communication Systems Engineering Laboratory	PC	-	-	3	3	50	50	2
ECE 327	Microcontrollers & Embedded Systems Laboratory	PC	-	-	3	3	50	50	2
ECE 328	Soft Skills Laboratory	HS	-	-	3	3	100	-	2
ECE 329	Quantitative Aptitude & Verbal Aptitude-II	HS	4	-	-	4	100	-	2
Total			20	5	9	34	500	400	24

ProfessionalElective-I

1.AnalogICDesign 2.EMI/EMC

3. Electronic Measurements and Instrumentation4.TelecommunicationsandswitchingNetworks

Industrial Training during summer vacation after Third Year II –Semester. But its grade will be accorded with the 4-1 courses of the program

INTRODUCTION TO EMBEDDED SYSTEMS	
ECE 311(a)	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course objectives:

- This course emphasizes on brief treatment of embedded hardware and working principle of a sensors, ADCs and actuators used in embedded system and its applications.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Acquire knowledge about the general principles of computer architecture.
2.	Acquire working of a simple embedded system and its applications
3.	Acquire knowledge of the hardware aspects of embedded systems
4.	Analyze functionality of the sensors, ADCs and actuators used in embedded systems
5.	Analyze the real time examples of embedded systems

Mapping of Course Outcomes with Program Outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	2	-	-	-	-	-	-	-	-	-	-	1
	2	2	-	-	-	-	-	-	-	-	-	-	1
	3	2	-	-	-	-	-	-	-	-	-	-	1
	4	2	1	-	-	-	-	-	-	-	-	-	2
	5	3	2	-	-	-	-	-	-	-	-	-	2

SYLLABUS

UNIT I: **8 Periods**

Basics of computer architecture and the binary number system

Basics of computer architecture, computer languages, RISC and CISC architectures, numbersystems, number format conversions, computer arithmetic, units of memory capacity

UNIT II: **8 Periods**

Introduction to embedded systems

Application domain of embedded systems, desirable features and general characteristics of embedded systems, model of an embedded system, microprocessor Vs microcontroller, example of a simple embedded system, figure of merit for an embedded system, classification of MCUs: 4/8/16/32 bits, history of embedded systems, current trends

UNIT III: **10 Periods**

Embedded systems-The hardware point of view

Microcontroller unit(MCU), a popular 8-bit MCU, memory for embedded systems, low powerdesign, pull up and pull down resistors

UNIT IV: **12 Periods**

Sensors, ADCs and Actuators

Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing; Actuators Displays, Motors, Opto couplers/Opto isolators, relays.

UNIT V: **12 Periods**

Examples of embedded systems

Mobile phone, automotive electronics, radio frequency identification (RFID), wireless sensor networks(WISENET), robotics, biomedical applications, brain machine interface

Text Books:

1. Lyla B Das, *Embedded systems: An Integrated Approach*, 1st Ed., Pearson, 2013

Reference Books:

1. Shibu, K.V., *Introduction to Embedded Systems*, 1st Ed., TMH, 2009
2. Kanta Rao B, *Embedded Systems*, 1st Ed., PHI
3. Frank Vahid & Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley,

ELECTROMAGNETIC INTERFERENCE AND COMPATABILITY	
ECE 311(b)	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sectional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To familiarize with the fundamentals that are essential for electronics industry in the field of EMI / EMC
- To understand EMI sources and its measurements
- To understand the various techniques for electromagnetic compatibility.
- Acquire broad knowledge of various EM radiation measurement techniques.
- Model a given electromagnetic environment/system so as to comply with the standards.

Course Outcomes:

By the end of the course the student will be able to :	
1.	Apply the concept of EMI / EMC related to product design & development.
2.	Analyze the different EM coupling principles and its impact on performance of electronic system.
3.	Design and analyze the given system to bring down the electromagnetic interference using the concepts of both susceptibility and immunity.
4.	Design and analyze systems using knowledge of various EM radiation measurement techniques
5.	Design and analyze systems for reduction of Electromagnetic interference following EMI standards

Mapping of Course Outcomes with Program Outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	2		1			1						2
	2	1	2	1									1
	3	3	2	3			2						2
	4	3	2	3	1			1	1				1
	5	3	2	3									2

SYLLABUS

Unit I: EMI / EMC Concepts 12periods

EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted andRadiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.

Unit II: EMI Coupling Principles 12periods

Conducted, radiated and transient coupling; Common ground impedance coupling; Commonmode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling,cross talk ; Field to cable coupling ; Power mains and Power supply coupling.

Unit III: EMI Control Techniques 12periods

Shielding- Shielding Material-Shielding integrity at discontinuities, Filtering-Characteristics of Filters-Impedance and Lumped element filters-Telephone line filter, Power line filter design, Filter installation and Evaluation, Grounding- Measurement of Ground resistance-system grounding for EMI/EMC-Cable shielded grounding, Bonding,

Isolation transformer, Transient suppressors, Cable routing, Signal control. EMI gaskets

Unit IV:EMI /EMC Measurements 12periods

Open area test site; TEM cell; Anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer.

Unit V:EMI /EMC and Standards 12periods

Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462. Frequency assignment - spectrum conversation. British VDE standards, Euro norms standards in Japan - comparisons. EM Emission and Susceptibility standards and Specifications.

REFERENCES:

1. V. P. Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press,New York, 2000.
2. R. C. Paul, “Introduction to Electromagnetic Compatibility”, John Wiley and Sons, Inc,1992.

COMMUNICATION SYSTEMS ENGINEERING	
ECE 312	**Credits: 4**
Instruction: 4 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:

Engineering Mathematics, Signals and Systems, Electronic Circuit Analysis.

Course Objectives:

- To understand basic concepts of various modulation and demodulation techniques and the importance of Fourier theory in communication Systems.
- To familiarize students with angle modulation and demodulation techniques.
- To understand the functioning of AM and FM transmitters and receivers.
- To describe the impact of noise on analog modulation schemes.
- To acquire knowledge about the overview of satellite systems.

Course Outcomes:

By the end of the Course, the students will be able to:	
1.	Illustrate different AM modulation and demodulation schemes.
2.	Analyze generation and detection of FM and PM signal.
3.	Analyze the functioning of AM and FM Transmitters and Receivers.
4.	Evaluate the impact of noise in AM and FM modulation schemes. Differentiate between Pulse Modulation and Demodulation techniques.
5.	Illustrate principle of operation of satellite orbits, its launching methods, Link design, earth segment and space segment components.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	1	2	1											2	
	2.	3	3	1											3	
	3.	2	3	1											3	
	4.	3	2	1											2	
	5.	2	1										1		1	

SYLLABUS

UNIT I **15 periods**

Introduction to Communication Systems:

Basic Block Diagram of Communication Systems; Principles of Analog and Digital Communication; Linear Modulation Systems: Need for Modulation, Frequency Translation,Method of Frequency Translation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Square law modulator and diode detector, DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, Costas loop, Hilbert transform , properties & applications, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, VSB, Applicationsof AM Systems.

UNIT II **15 periods**

Non Linear Modulation Systems:

Angle Modulation, Phase and Frequency Modulation and their Relationship, Phase and Frequency Deviation, NBFM, WBFM, Spectrum of an FM Signal, Bandwidth of

Sinusoidal Modulated FM Signal, Carson‟s rule, Effect of the Modulation Index on Bandwidth, Comparison of FM and PM; Generation of FM Waves: Direct Method- Varactor diode, Indirect Method- Armstrong Method; Detection of FM Waves: Balanced Frequency discriminator, Phase locked loop, Comparison of FM and AM.

UNIT-III **10 periods**

Radio Transmitters & Receivers: Radio Transmitters: AM and FM Transmitters, SSB Transmitters; Radio receiver: Tuned radio frequency receiver, Superhetrodyne receiver, AM Receivers – RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers – Amplitude Limiting.

UNIT-IV **15 periods**

Noise & Noise performance of AM & FM systems:
Thermal noise, shot noise, Flicker Noise and Transition Noise, Signal to Noise ratio, Noise equivalent bandwidth, Noise equivalent temperature, Noise figure, Figure of merit, Noise in AM Systems: DSB-SC, SSB-SC, AM with carrier (Envelope Detector); Noise in FM, pre-emphasis & De-emphasis, threshold effect, problems. **Analog Pulse Modulation Techniques:** Pulse modulation and its types, PAM, PWM, PPM, concepts of Time Division Multiplexing, Frequency Division Multiplexing.

UNIT-V **10 periods**

Satellite Communications:
Introduction, History of Satellites, Kepler‟s laws, Satellite orbits, Geosynchronous Satellites, Launch vehicle, `Antenna look angle, Satellite system link models- Uplink, Transponder, Down link model, Cross-Links, satellite system parameters, satellite system Link equations, satellite system Link Budget.

Text Books

1. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," 2nd Edition, OxfordUniversity Press, 2010.
2. Simon Haykins, "*Communication Systems*," Wiley, Fifth edition, 2009.
3. P.Ramakrishna Rao, "*Analog communications*" Tata McGraw Hill Education PrivateLimited. 2011.

Reference Books

1. H P Hsu, "*Analog and digital communications*" Schaum‟s outlines, McGraw-HillEducation; 2 edition, 2002.
2. Wayne Tomasi, "*Electronic Communications Systems: Fundamentals ThroughAdvanced*,"- Pearson Education, Fifth Edition, 2011.
3. Robert J. Schoenbeck, *Electronic Communications Modulation and Transmission*, PHI N. Delhi, 1999.
4. G. Kennedy, "*Electronic Communication Systems*," McGraw Hill, 2nd Edition, 1977.

MICROPROCESSORS AND APPLICATIONS	
ECE 313	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Digital Electronics.

Course Objectives:

- To understand the internal architecture of 8085 microprocessor & Instruction Set
- To understand the internal architecture of 8086 microprocessor
- To program the 8086 microprocessor to meet the requirements of the user
- To interface memory and peripherals through various interfacing ICs to 8086 microprocessor

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Able to program 8085 microprocessor to meet the specific requirements of the client
2.	Able to organize the hardware involved in BIU & EU of 8086 microprocessor & analyze the minimum and maximum mode 8086 systems using timing diagrams
3.	Able to program 8086 microprocessor to meet the specific requirements of the client
4.	Able to interface 8086 microprocessor to semiconductor memories (SRAM & EPROM), stepper motor to meet the specific requirements of the Client, Also able to generate a specific waveform by designing an interface between a CRO and 8086 microprocessor & able to convert a given analog sample value into its equivalent digital value by designing an interface between 8086 microprocessor and analog input using A/D converter to meet the meet the specific requirements of the Client
5.	Able to design interface between peripheral devices and 8086 microprocessor using 8259 (Programmable Interrupt Controller) to get services from 8086 microprocessor on Interrupt basis & able to interface USART to 8086 to perform serial communication.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO											PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2												2
	2	2	1	2												2
	3	2	1	2												2
	4	2	1	2												2
	5	2	1	2												2

SYLLABUS

UNIT I: 16 Periods

Overview of 8085 (Architecture & Instruction Set):

Introduction to Microprocessors and Microcomputers, Internal Architecture and Functional Description of INTEL 8085 Microprocessor, Interrupt Structure of 8085, Instruction Set of 8085 μP and Sample programs.

UNIT II: 08 Periods

8086 Architecture:

Architecture of 8086, Register organization, Memory segmentation. Physical memory organization. signal description of 8086, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings.

UNIT III: 15 Periods

Instruction Set and Assembly Language Programming of 8086: Addressing modes, instruction set, assembler directives(Significant), macros and operators. Simple programs involving arithmetic, logical, branch and string manipulation instructions.

UNIT IV: 09Periods

Interfacing – I:

Memory interfacing to 8086 (Static RAM & EPROM).

Methods of parallel data transfer, 8255A Internal block diagram and system connections, 8255A operational modes and initialization, constructing and sending 8255A control words, interfacing to 8086. Interfacing Stepper motor, D/A and A/D converters

UNIT V: 08 Periods

Interfacing – II:

8086 Interrupts and response, Interrupt vector table, Types of Interrupts, 8259 PIC Architecture and interfacing, cascading of interrupt controller to 8086, 8253/8254, modes of 8253 & Interfacing.

Serial data transfer schemes: Asynchronous and Synchronous data transfer schemes. 8251 USART architecture and interfacing to 8086. RS-232.

Text Books:

1. Ramesh S. Gaonkar, *Architecture Programming and Applications*, 3rd Edition, Penram International Pvt. Ltd.
2. D. V. Hall, *Microprocessors and Interfacing*, Revised 2nd edition 2006, TMH,.
3. A.K. Ray and K.M. Bhurchand, *Advanced Microprocessors and Peripherals*, 2nd edition, 2006, TMH.

Reference Books:

1. John Uffenbeck, *The 8086/8088 Family: Design, Programming And Interfacing*, PHI
2. N. Senthil Kumar, M. Saravanan, and S. Jeevananthan, *Microprocessors and Microcontrollers*,OUP India

COMPUTER ARCHITECTURE AND ORGANIZATION	
ECE314	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Digital Electronics.

Course Objectives:

- To understand the basic concepts and structure of computers.
- To understand the concepts of register transfer logic and arithmetic operations.
- To explain different types of addressing modes and memory organization.
- To learn the concepts of pipelining and multiprocessors.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Illustrate the principle of operation of register transfer and use assembly language instructions of a computer for a given task.
2.	Organize the hardware involved in the CPU of a computer
3.	Design a simple CPU with applying the theory concepts.
4.	Use computing resources such as memory and I/O in an effective manner to improve the performance of a computer
5.	Illustrate the concept of pipelining and multiprocessors

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1														3
	2	2	2	2												3
	3	2	2	2												3
	4	2	2													2
	5	1	1													1

SYLLABUS

UNIT I : **9 Periods**

Register Transfer and Microoperations :

Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit

UNIT II : **12 Periods**

Basic Computer Organization :

Instruction Codes, Computer Registers, Computer Instructions, hardwired control unit,Instruction Cycle, Memory Reference Instructions

Microprogrammed Control :

Control Memory, Address Sequencing, Microinstruction Formats, Micro program Example,Design of Control Unit

UNIT III : **9 Periods**

CPU Organization

Introduction, General Register Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, , Stack Organization. Reduced Instruction Set Computer(RISC) and CISC architectures

UNIT IV : **9Periods**

Memory Organization

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory

UNIT V : **11 Periods**

Input - Output Organization

Peripheral Devices, Input - Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA),Introduction to pipelining, multiprocessors

Text Book

1. M. Morris Mano, *Computer System Architecture*, 3rd Ed., PHI, 1996

Reference Books

1. V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, *Computer Organization*, 5th Ed., McGraw Hill International, 2011
2. Sivarama P. Dandamudi, *Fundamentals of computer Organization and design*, Springer, 2002
3. William Stallings,*Computer Organization & Architecture - Designing for performance*, 8th Ed., Pearson Education India, 2013
4. John D. Carpinelli,*Computer Systems Organization & Architecture*, 1st Ed., Pearson Education India, 2000
5. Sajjan G. Shiva, *Computer design and architecture*, 3rd Ed., Marcel Dekker, 2000
6. Hennessy- Patterson, *Computer Architecture: A quantitative approach*, 5 th edition, Morgan Kaufmann, 2011

INTEGRATED CIRCUITS AND APPLICATIONS	
ECE315	**Credits:3**
Instruction: 3 periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites:

Network Theory and Synthesis, Electronic Circuits and Analysis-II

Course Objectives:

- To provide the students strong fundamentals in the field that is relevant for engineers to design Linear circuits using Op-amps.
- To teach active filter using operational amplifiers and their comparison
- To introduce the theory and applications of PLL and Analog multiplier
- To familiarize the students with conversion of data from Analog to Digital and Digital to Analog.
- To introduce concepts of sine wave generation and some special function ICs

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyze and Design the static and dynamic electrical behavior of CMOS circuits.
2.	Analyze and design active filters using op-amp & IC Voltage regulators.
3.	Design circuits for different applications using IC 555 Timer and analyze the PLL & VCO ICs for different applications.
4.	Analyze and design different types of data convertors.
5.	Analyze and design the combinational and Sequential circuits using digital ICs.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO											PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1												
	2	2	2	1									1			1
	3	2	2	1									1			2
	4	2	2	1									1			1
	5	2	2	1									1			2

SYLLABUS

UNIT I: **12 Periods**

Digital Circuits:

CMOS logic, electrical behavior of CMOS circuits-Static and Dynamic, Low -Voltage CMOS logic and interfacing, CMOS/TTL interfacing

UNIT II: **12 Periods**

Voltage regulators & Active Filters:

IC Voltage regulators - Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator

Filter Fundamentals: Filter types, Realizing Practical Filters: Sallen-Key LPF and HPF Realizations-BPF Realization-Notch Filter (Band Reject) Realization - All Pass Filters, Switched Capacitor filter

UNIT III:

Timer, Phase Locked Loop and Analog Multiplier: **12 Periods**

IC 555 Timer: Functional block diagram and description, Monostable, Astable operation and their applications, 556 Voltage Controlled Oscillator - -Phase Locked Loop-Operation of 565

PLL-Closed loop analysis of PLL- PLL Applications: Frequency Synthesis - Frequency Translation - AM and FM detection, analog multiplier ICs.

UNIT IV: 12 Periods

Analog to Digital and Digital to Analog Converters :

Digital to Analog converters - Binary weighed and R-2R Ladder types - Analog to digital converters - Continuous - Counter ramp, successive approximation, single, dual slope and parallel types

UNIT V: 12 Periods

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

Sequential Logic ICs: Familiarity with commonly available 74XX & CMOS 40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Text Books:

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001
2. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", New Age Science, 2010
3. John F Wakerly, “Digital Design-Principles and practices”, 4th Ed., Pearson, 2008

Reference Books:

1. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.
2. Sonde, B.S, “Introduction to System Design using Integrated Circuits”, Second Edition, Wiley Eastern Limited, New Delhi, 1994
3. Michael Jacob J., "Applications and Design with Analog Integrated Circuits ", Prentice Hall of India, 1996.
4. Robert F Coughlin and Fedrick F Driscoll ―Operational amplifiers and linear Integrated Circuits‖, 6th edition, Prentice Hall of India, New Delhi, 2006.
5. Richard J. Higgins "Electronics with Digital and Analog Integrated Circuits‖, Prentice Hall of India, New Delhi, 1983.
6. George Clayton and. Steve Winder - Operational Amplifiers, 5th edition. Elsevier, 2003
7. Sergio Franco - Design with operational amplifiers and analog integrated circuits, 3rd ed., McGraw-Hill Education, 2001

ANTENNAS AND WAVE PROPAGATION	
ECE 316	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: EMFT

Course Objectives:

- To introduce antennas – their basic radiation mechanism, their principle of operations, design, analysis and their applications.
- To provides a platform to introduce concepts of wave propagation over ground, through troposphere and ionosphere, and propagation effects at different radio frequencies.

Course Outcome:

By the end of the course, the students will be able to:
Determine the radiation characteristics of basic antenna elements.
Illustrate the construction details and radiation properties of practical antennas used in applications operating from LF to microwave frequency.
Design and Analyze the linear antenna arrays with the given specifications.
Interpret the methods for measuring the antenna parameters.
Comprehend the modes and characteristics of radio propagation.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1	3	3	1											3	
	2	3	3	2											3	
	3	3	3	3											3	
	4	2	3	1									1		3	
	5	2	3	1									1		3	

SYLLABUS

UNIT I **12 Periods**

Radiation Mechanism and Antennas Basics

Antenna definition, Functions of antennas , Network theorems, Properties of antennas, Antenna parameters. Radiation mechanism, Radiation fields of alternating current element, Radiated power and radiation resistance; Radiation, induction and electrostatic fields. Different current distributions in linear antennas, Radiation from half-wave dipole, quarter wave mono pole and their characteristics. Radiation patterns of alternating current element, dipoles and monopoles.

UNIT II **12 Periods**

Types of Antennas & Applications

Introduction, Isotropic radiators, Directional antennas, omnidirectional antennas, Resonant antennas, Non-resonant antennas, LF, HF, VHF and UHF antennas. Folded dipole, V-Antennas, Inverted V-antennas, Rhombic antenna, Yagi-Uda antenna, Log-periodic antennas, Loop antenna, Helical antennas. Microwave Antennas: Rod reflector, Plane reflector, Corner reflector, Parabolic reflector, Types of parabolic reflectors, Feed systems for parabolic reflectors, Shaped beam antennas, Horn antennas, Corrugated horns, Slot antennas, Slots in the walls of rectangular waveguides, Babinet‟s principle, Lens antennas, Microstrip antenna and feeding techniques.

UNIT III **12 Periods**

Analysis & Synthesis of Linear Arrays

Two-element uniform array, Uniform linear arrays, Field strength of a uniform linear array, First sidelobe ratio (SLR), Broadside and End-fire arrays, Patterns of array of non-isotropic radiators, Multiplication of patterns, Generalized expression for principle of pattern multiplication, Radiation pattern characteristics, Binomial arrays.Transmission loss between transmitting and receiving antennas - FRIIS formula, Antenna temperature and signal-to-noise ratio. Schelkunoff Synthesis methods, Fourier transform method, Linear array design by Woodward-lawson method, Dolph-chebychev method (Tschebyscheff distribution), Taylor method, Laplace transform method, Standard amplitude distributions. Introduction to planar & phased arrays.

UNIT IV **12 Periods**

Antenna Measurements

Introduction, Drawbacks of measurements of antenna parameters, Methods to overcome drawbacks in measurements, Methods for accurate measurements, TEM cell, GTEM cell, Anechoic chamber, Measurement ranges, Indoor and outdoor ranges, Antenna impedance measurements, Measurement of radiation resistance, Gain measurements, Measurement of antenna bandwidth, Directivity measurement, Measurement of sidelobe ratio, Measurement of radiation efficiency, Measurement of antenna aperture efficiency, Measurement of polarization of antenna, Phase measurement.

UNIT V **12 Periods**

Wave Propagations

Propagation characteristics of EM Waves, Factors involved in the propagation of radio waves, Ground wave propagation, Ground wave field strength by Maxwell‟s equations, Reflection of radio waves by the surface of the earth, Roughness of earth, Reflection factors of earth, Wave tilt of the ground wave, Tropospheric wave propagation, Atmospheric effects in space wave propagation, Duct propagation, Radio horizon, Troposcatter, Fading of EM waves in Troposphere, Line of sight (LOS), Ionospheric propagation, Characteristics of ionosphere, Refractive index of ionosphere, Phase and group velocities, Mechanism of Ionospheric propagation, reflection and refraction, Characteristic parameters of Ionospheric propagation, Sky wave field strength, Fading and diversity techniques, Faraday‟s rotation, Effect of earth‟s magnetic field.

Text Book

1. C.A. Balanis, *Antenna Theory*, John Wiley & Sons, NY, 3rd edn., 2005.
2. G.S.N. Raju, *Antennas and Wave Propagation*, Pearson Education (Singapore) Pvt., Ltd., New Delhi, 2007.

Reference Books:

1. E. C. Jordan and K. G. Balmain, *EM Waves and Radiation Systems*, PHI – N. Delhi,2nd Edn., 2000.
2. J.D. Kraus, *Antennas*, McGraw Hill, NY,2nd Edn., 1988.

MICROPROCESSORS & APPLICATIONS LABORATORY	
ECE 317	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:

Microprocessors and Applications

Course Objectives:

- To understand the internal architecture of 8085 microprocessor & Instruction Set
- To understand the internal architecture of 8086 microprocessor
- To program the 8086 microprocessor to meet the requirements of the user
- To interface memory and peripherals with 8086 microprocessor

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Program 8085 & 8086 microprocessor to meet the requirements of the user.
2.	Interface peripherals like switches, LEDs, stepper motor, Traffic lights controller, etc..,
3.	Apply concept & types of interrupts for the given context.
4.	Design a microcomputer to meet the requirement of the user

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	2	2	2			1	1	1					2
	2	3	2	2	2	2			1	1	1					2
	3	2	2	2	2	2			1	1	1					2
	4	2	2	3	3	2			1	1	1					3

List of Experiments

Experiments using 8085 Microprocessor trainer:

1) Write a program, which loads Registers, A, B, C, and D with the same constant. Try to optimize the program in such a way that the smallest numbers of program bytes are used. Test the program in single step mode. After each step, test the register of interest.

   Assume that 4 bytes of data are stored at consecutive locations of the data-memory starting at (x). Write a program, which loads Registers E with (x), D with (x+l), C with (1+2) and A with (x+3).

   a. Assume that l byte of data is stored at data memory location (x). Write a program which tests bit 5 of (X). Write „FF" in (x+1), if bit 5=0 and write „00" at the same location if bit 5=1.
   b. Write a program which tests the zero-condition of a data byte specified at data memory location (x). If it is zero „00" should be stored at (x+1) location, if non-zero „FF" should be stored at the same location.
   c. A binary number is stored at data-memory location (x) Compute the number of its logical 1"s and store the result at y.
   d. Comment on the instructions used in the above three programs and write about the effect of flags with the instructions used.

2) Two unsigned binary numbers are stored at data-memory locations (x) and (x+1).
   a. Compute the sum of the two numbers and store the result at y, ignoring the possible overflow.

b. Write a program to compute (x+1) - (x). The magnitude of the result should be stored at (y) and the sign (00 if positive, 01 if negative) at (y+1). Understand the 2‟s compliment Arithmetic.

3) N binary numbers stored at consecutive data memory locations starting at (x) where N is defined at data memory location „NUMBER‟.
   a. Find the largest number and display it in the data field and arrange them in ascending order.
   b. Find the smallest number and display it in the data field and arrange them in descending order.
4) Two 8-bit binary numbers are stored at data memory locations (x) and (x+1) compute product of the two numbers using, a). Successive addition method. b). Shifting and adding method store the result in (y) and (y+1).

Experiments using 8086 Microprocessor trainer/TASM/MASM:

5) Addition of a) 16-bit numbers b) 32-bit numbers
6) Factorial of a number, Fibonacci series
7) Hexadecimal and decimal counters
8) Sorting of numbers

Interfacing experiments with 8086 Microprocessor trainer:

9) Interfacing of D/A converter
10) Interfacing of A/D converter
11) 8255 Study Card – Interfacing I/O Devices
12) Interfacing of stepper motor
13) Interfacing of 7-segment display/Traffic light controller

Note: A student has to perform a minimum of 10 experiments.

Text Books:

1. Ramesh S. Gaonkar, *Architecture Programming and Applications*, 3rd Edition, Penram International Pvt. Ltd.
2. D. V. Hall, *Microprocessors and Interfacing*, Revised 2nd edition 2006, TMH,.
3. A.K. Ray and K.M. Bhurchand, *Advanced Microprocessors and Peripherals*, 2nd edition, 2006, TMH.

INTEGRATED CIRCUITS LABORATORY	
ECE318	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:

Digital Electronics, Integrated Circuits and Applications

Course objectives:

- To understand the non-linear applications of operational amplifiers (IC741)
- To familiarize with theory and applications of IC555 timers.
- To design and construct waveform generation circuits using Op-Amp
- To design multivibrator circuits using IC555
- To design and analyze combinational and sequential logic circuits

Course Outcomes:

By the end of the course, the student will be able to	
1.	Analyze and Design the circuits using op-amps for various applications like Schmitt Trigger, Precision Rectifier, Comparators and three terminal IC 78XX regulator.
2.	Analyze and Design active filters for the given specifications and obtain their frequency response characteristics.
3.	Design and analyze multivibrator circuits using op-amp and 555Timer
4.	Design and analyze various combinational circuits like multiplexers, and de-multiplexers, binary adder, subtractor, etc
5.	Design and analyze various sequential circuits like flip-flops, counters etc

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	2	3	1			1	1	1					2
	2	2	2	2	3	1			1	1	1					2
	3	2	2	2	3	1			1	1	1					2
	4	2	2	2	3	1			1	1	1					2
	5	2	2	2	3	1			1	1	1					2

List of Experiments:

1) Application of Operational Amplifiers
2) Design and testing of Active LPF & HPF using op-amp
3) Design of Schmitt Trigger using op-amp
4) Design of Astable multivibrator using a) op amp b) IC 555
5) Line and load regulation of three terminal IC Voltage Regulator.
6) Operation of R-2R ladder DAC and flash type ADC
7) Simulation of any 4 Experiments 1, 2, 3, 4 , 5 and 6 using Multisim software
8) Minimization and Realization of a given Function using Basic Gates (AND, OR, NOR, NAND, EXOR).
9) Design and implementation of code converters using logic gates (i) BCD to excess-3 code

(ii) Gray to binary

10) Design of binary adder and subtractor

11) Design and implementation of Multiplexer and De-multiplexer using logic gates.

12) Implementation and Testing of RS Latch and Flip-flops – D, JK and T.

13) Design of synchronous counters

14) Design of asynchronous counters

Note: A student has to perform a minimum of 12 experiments.

Text Books:

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001
2. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", New Age Science, 2010
3. John F Wakerly, “Digital Design-Principles and practices”, 4th Ed., Pearson, 2008
4. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.

QUANTITATIVE APTITUDE - I	
ECE 319	**Credits: 2**
Instructions: 4 Periods/week	Sessional Marks: 100

Prerequisites: Nil

Course Objectives:

- To enhance the problem solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of competitive examinations.

Course Outcomes:

Quantitative Aptitude –I

By the end of the course student will be able to :	
1.	Solve problems related to numerical computations in company specific and other competitive tests
2.	Recall and use the concepts to solve problems numerical estimation with respect to company specific and competitive tests.
3.	Apply basic principles related to geometry and mensuration & solve questions in company specific and competitive tests.

Verbal Aptitude-I:

By the end of the course student will be able to :	
1.	Detect grammatical errors in the text/sentences and rectify them while answering their competitive company specific tests and frame grammatically correct sentences while writing.
2.	Answer questions on synonyms, antonyms, hyponyms, hypernyms and other vocabulary based exercises while attempting company specific and other competitive tests.
3.	Use their logical thinking ability and solve questions related to reasoning based exercises.
4.	Choose the appropriate word/s/phrases suitable to the given context in order to make the sentence/paragraph coherent
5.	Analyze the given data/text and find out the correct responses to the questions asked based on the reading exercises; identify relationships or patterns within groups of words or sentences.

SYLLABUS

Section –A (Quantitative Aptitude –I)

UNIT I **6 Periods**

Numerical computation:

Applications based on Numbers, Chain Rule, Ratio Proportion

UNIT II **6 Periods**

Numerical estimation - I

Applications Based onTime and work, Time and Distance

UNIT III **4 Periods**

Numerical estimation – II

Applications based on Percentages, Profit Loss and Discount, Simple interest and Compound Interest Partnerships, Shares and dividends

UNIT IV **4 Periods**

Data interpretation

Data interpretation related to Averages, Mixtures and allegations, Bar charts, Pie charts, Venn diagrams

UNIT V **4 Periods**

Application to industry in Geometry and Mensuration

Books for practice

1. Quantitative aptitude by RS Agarwal, S Chand Publications
2. Verbal and non verbal Reasoning by RS Agarwal from S Chand publications

References

1. Barron‟s by Sharon Welner Green and Ira K Wolf (Galgotia Publications pvt. Ltd.)
2. Quantitative Aptitude by U Mohan Rao Scitech publications
3. Quantitative Aptitude by Arun Sharma McGrawhill publications
4. Quantitative Aptitude by Ananta AsishaArihant publications
5. Quantitative Aptitude by Abhijit Guha
6. Quantitative Aptitude by Pearson publications
7. Material from „IMS, Career Launcher and Time‟ institutes for competitive exams.
8. Elementary and Higher algebra by HS Hall and SR knight.

Websites:

www.m4maths.com
www.Indiabix.com
800score
Official GRE site
Official GMAT site

Section –B (Verbal Aptitude –I)

UNIT I **7 Periods**

Grammar:

Parts of speech(with emphasis on appropriate prepositions, co-relative conjunctions, pronouns-number and person, relative pronouns), articles(nuances while using definite and indefinite articles), tenses(with emphasis on appropriate usage according to the situation), subject – verb agreement (to differentiate between number and person) , clauses (use of the appropriate clause , conditional clauses), phrases(use of the phrases, phrasal verbs), degrees of comparison(comparing apples and oranges, comparison and number), modifiers(misplaced and dangling modifiers, absence of modifiers), determiners, parallelism in structure(symmetry in two part sentences), word order, subjunctive mood, redundancy, special types of sentences, miscellaneous types, identifying errors in a given sentence, correcting errors in sentences.

UNIT II **4 Periods**

Vocabulary:

Synonyms and synonym variants (with emphasis on high frequency words), antonyms and antonym variants (with emphasis on high frequency words), homonyms, hyponyms, hypernyms and General idioms.

UNIT III **5 Periods**

Reasoning:

Critical reasoning (understanding the terminology used in CR- premise, assumption, inference, conclusion), Sequencing of sentences (to form a coherent paragraph, to construct a meaningful and grammatically correct sentence using the jumbled text), to use logical reasoning and eliminate the unrelated word from a group.

UNIT IV **4 Periods**

Usage:

Sentence completion (with emphasis on signpost words and structure of a sentence), contextual meanings (to use the appropriate word according to the situation), supplying a suitable beginning/ending/middle sentence to make the paragraph coherent, idiomatic language (with emphasis on business communication), punctuation depending on the meaning of the sentence, run on errors, sentence fragments, coma splices.

UNIT V **4 Periods**

Reading Comprehension:

Types of passages (to understand the nature of the passage), types of questions (with emphasis on inferential and analytical questions), style and tone (to comprehend the author‟s intention of writing a passage), strategies for quick and active reading(importance given to skimming, scanning), summarizing ,reading between the lines, reading beyond the lines, techniques for answering questions related to vocabulary (with emphasis on the context), supplying suitable titles to the passage, identifying the theme and central idea of the given passages.

Books for Practice

1. Practical English Grammar A. J. Thomson, A. V. Martinet by Oxford University press
2. Remedial English Grammar for Foreign Students by FT wood published by Macmillan Publishers
3. Objective English-Edgar Torpe, Showick Thorpe-Pearson Education
4. Cambridge and Oxford Dictionaries

Reference Books and websites:

1. Barron‟s by Sharon Welner Green and Ira K Wolf (Galgotia Publications Pvt.Ltd.)
2. Websites: Indiabix, 800 score, official CAT, GRE and GMAT sites
3. Material from „IMS, Career Launcher and Time‟ institutes for competitive exams.
4. Collins Cobuild English Grammar by Goyal Publishers
5. Word Power Made Easy by Norman Lewis-Goyal Publishers

MICROWAVE & RADAR ENGINEERING	
ECE 321	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To understand microwave waveguides, passive & active devices, tubes and network analysis.
- To learn how to design microwave matching networks.
- To learn how to perform microwave measurements.
- To understand RADARs and its applications.

Course Outcomes:

At the end of the course the student will be able to	
1.	Apply Electromagnetic field theory to rectangular waveguide and analyze waveguides.
2.	Analyze the working of passive microwave components using S-matrix.
3.	Apply the operating principles in generating/amplifying microwave signals using microwave tubes and solid state devices.
4.	Analyze microwave signals/devices using bench setup for the determination of microwave parameters.
5.	Apply the principles of Radar to identify the parameters of target.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3												3	
	2	3	3	1											3	
	3	2	3												3	
	4	2	3	2											3	
	5	2	3				1								3	

SYLLABUS

UNIT I **12 periods**

Microwave Components:

Introduction to Microwaves, advantages and applications; Coaxial Line Components; Theory of Guided Waves- Waves in between parallel plates parallel plate, Wave Guide – Derivation of Field Equations, Modes of Propagations, and their parameters, Types of Wave-guides; Excitation methods for different TE and TM modes, Evanescent mode, Wave impedance in waveguide; Attenuators; Ferrite Devices - Isolators, Circulators; Cavity Resonators, Re-entrant Cavities, Wave-meters, Waveguide Iris, posts, screws, Microwave Filters, Detectors.

UNIT II **12 periods**

Microwave Circuits:

Scattering Matrix and its Properties. Scattering Matrix of E Plane Tee, H plane Tee and Magic Tee, Directional coupler & its types, Scattering Matrix of Circulator, Isolator, Applications.

UNIT III **12 periods**

Microwave Signal Generators and Amplifiers:

Resonant Cavity Devices, Reflex Klystron, Two – Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes, Crystal

Diode.

UNIT IV **12 periods**

Microwave Measurements:

Introduction to Microwave bench setup, Measurement of Frequency, Wavelength, VSWR, Unknown impedance, attenuation. Coupling, Isolation and Directivity measurements of Directional coupler. Microwave power measurement, dielectric constant measurement, .

UNIT V **12 periods**

Radar Engineering :

Radar Range Equation, Radar Block Diagram and Operation, Prediction of Range, Minimum Detectable Signal, Receiver Noise, Radar Cross-section, Transmitter Power, PRF and Range Ambiguities, Radar Antenna Parameters, System Losses and Propagation Effects. Types of radars- MTI & Pulse Doppler Radar, Tracking Radar –Principles; Synthetic Aperture Radar, Phased Array Radar Semi Active and Active Array Radars – Introduction.

Text Books:

1. Simon Kingsley and Shaun Quegan, "*Understanding Radar Systems*", SciTech Publishing, 1999.
2. G.S.N. Raju, "*Microwave Engineering*",1st ed., IK International Publishers,
3. G. Sasibhushan Rao, "*Microwave & Radar Engineering*" ,1st ed., Pearson Education,2014.

Reference Books:

1. G.S.N Raju, "*Radar Engineering and Fundamentals of Navigational Aids*", 1st ed. IK International Publishers, 2008
2. M.I. Skolnik, "*Introduction to Radar Systems*", McGraw Hill, 2007.
3. R. R. Collin, "*Foundations for Microwave Engineering*", 2nd ed., McGraw Hill.2015.

DIGITAL SIGNAL PROCESSING	
ECE 322	**Credits : 4**
Instruction : 4 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: ECE 214

Course Objectives:

- To familiarize with DFT and FFTs for Digital Signal Processing applications.
- To learn about the various design procedures in IIR and FIR Digital filter techniques.
- To learn about DSP processors which can be used for practical applications.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Classify different types of signals mathematically and perform basic operations on time and amplitude of DT signals and analyze the signals using Fourier Analysis and Z-transforms.
2.	Transform DTS into frequency domain using DFT and FFT and compare these two methods with respect to their computation complexity
3.	Design and realize IIR digital filters for a arbitrary frequencies and attenuation values
4.	Design and realize FIR digital filters for a arbitrary frequencies and attenuation values
5.	Illustrate the architecture and operation of DSP processor and outline the various applications of DSP in speech processing.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	2						1	1			3	2	
	2	3	3	2						1	1			3	2	
	3	3	3	3						1	1		1	3		
	4	3	3	3						1	1		1	3		
	5	2	1				1			1	1			3		

SYLLABUS

UNIT I **12 Periods**

Introduction to Digital Signal Processing & Applications of Z-Transforms : Classification ofsignal & systems – linear shift invariant systems – stability and causality – Sampling of continuous signals, signal reconstruction – linear constant coefficient difference equations – frequency domain representation of discrete time signals and systems.

Review of Z-Transforms, Applications of Z – Transforms, Solution of difference equations – block diagram representation of linear constant coefficient difference equations- basic structure of IIR systems – basic structures of FIR systems – system functions - Finite Word Length Effects.

UNIT II **12 Periods**

Discrete Fourier Series & Fourier Transforms and FFTs: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties ofDFT, linear convolution of sequences using DFT, Computation of DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT III **16 Periods**

IIR & FIR Digital Filter Design Techniques: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters, Frequency transformations, Bilinear Transformations method, Impulse and Step invariance method. Design Examples: Analog- Digital transformations, Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.

UNIT IV **08 Periods**

Multirate Digital Signal Processing: Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion. Digital Filter Banks, sub band coding of speech signals.

UNIT V **12 Periods**

Introduction to DSP Processors & DSP Applications: Introduction to programmable DSPs - Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs, Multiple Access Memory - Multiport memory - VLSI architecture – Pipelining

- Special addressing modes - On-Chip Peripherals - Architecture of TMS 320C5X - Introduction, Bus Structure - Central Arithmetic Logic Unit - Auxiliary Register - Index Register - Block Move Address Register - Parallel Logic Unit - Memory mapped registers - program controller - Some flags in the status registers - On-chip registers, On-chip peripherals.

DSP Applications: Application of DSP in Speech Processing – DSP applications in Bio-Medical Engineering.

Text Books:

1. John G. Proakis, Dimitris G.Manolakis, *Digital Signal Processing, Principles,Algorithms, and Applications:* Pearson Education / PHI, 2007.
2. K Raja Rajeswari, *Digital Signal Processing* I.K. International Publishing House.
3. A.V.Oppenheim and R.W. Schaffer, *Discrete Time Signal Processing,* PHI.
4. B.Venkataramani, M.Bhaskar, *Digital Signal Processors – Architecture, Programmingand Applications,*TATA McGraw Hill, 2002.

Reference Books:

1. Alan V. Oppenheim and Ronald W. Schafer, *Digital Signal Processing,* PHI.
2. Sanjit K. Mitra, *Digital Signal Processing "A – Computer Based Approach",*Tata McGraw Hill.
3. C. Britton Rorabaugh, *DSP Primer* Tata McGraw Hill, 2005.
4. Robert J. Schilling, Sandra L. Harris CL *Fundamentals of Digital Signal Processingusing Matlab* Engineering;

MICROCONTROLLERS & EMBEDDED SYSTEMS	
ECE 323	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites:

Digital Electronics, Computer Architecture & Organization, Microprocessors and Interfacing

Course Objectives:

- To understand the Hardware architecture of 8051 microcontroller to enable programming and Interfacing of microcontroller.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyze the hardware features of Intel 8051 microcontroller such as timers, memory, interrupts and serial communication available in 8051 Microcontroller Family of devices
2.	Develop assembly language programs for data transfer, arithmetic, logical, and branching operations using instruction set of 8051 and apply them in control applications
3.	Develop applications that will provide solution to real world problems by Interfacing 8051 Microcontroller with various peripherals such as ADC, DAC, keyboard, display, Interrupt and Serial communication modules.
4.	Evaluate the Embedded system design flow from the requirements to the deployment level and analyze the hardware/software tradeoffs involved in the design of embedded systems.
5.	Illustrate the architecture, and memory organization of ARM and SHARC Processors and analyze the performance metrics of simple and networked Embedded systems

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO											PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1											1	2
	2	3	2	2											1	3
	3	3	2	2											1	3
	4	2	2	1			2						1		1	3
	5	2	2	1									1		1	2

SYLLABUS

UNIT I: **12 Periods**

8051 Microcontroller:

Introduction to Microcontrollers, comparing Microprocessors and Microcontrollers, Architectureof 8051 Micro controller, Register organization of 8051, SFRs, Addressing modes of 8051.

Pin configuration of 8051, Input/Output Ports and Circuits, External Memory, Counters/Timersand modes of Timers, Serial data Input/Output, Interrupts.

UNIT II: **12 Periods**

Assembly Language Programming of 8051

Programming the 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions.

UNIT III: **16 Periods**

Interfacing 8051

Interfacing with Keyboards, Displays, D/A and A/D converters, Multiple Interrupts, Serial Data Communication.

UNIT IV: **10 Periods**

Introduction To Embedded Systems

Embedded systems overview, design challenge, Processor technology, IC technology, Design Technology, Trade-offs.

UNIT V: **12 Periods**

Introduction to advanced architectures

ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.

Text Books:

1. Muhammed Ali Mazidi, Janice GillispieMazidi, Rolin D Mc Kinlay , *The 8051 Microcontroller and Embedded Systems Using Assembly and C*, 2nd Edition, Pearson Education, 2008.
2. Frank Vahid, Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley.
3. Rajeshwar Singh, Dr.D.K.Singh, *Embedded System Design*, 1st Ed., Dhanpat Rai, 2010

Reference Books:

1. Kenneth. J. Ayala, DhananjayV. Gadre, *The 8051 Microcontroller & Embedded Systems Using Assembly and C*, 1st edition, Cengage learning, 2010
2. David E. Simon, *An Embedded Software Primer*, Pearson Education
3. Satish Shah, *8051 Microcontrollers: MCS 51 Family and Its Variants*, 1/e, Oxford University Press, 2010
4. B. Kanta Rao, *Embedded Systems*, 1st Ed., PHI, 2011
5. Wayne Wolf, *Computers as Components-principles of Embedded computer system design*, Elsevier

ANALOG IC DESIGN	
ECE 324(a)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Network Analysis and Synthesis, Electronic Circuits Analysis-I, Electronic Circuits Analysis-II

Course Objectives:

- To analysis, design, and applications of modern analog circuits using integrated field effect transistor technologies.
- To introduce the principles of analog circuits and apply the techniques for the design of analog integrated circuit (Analog IC's).
- To apply the methods learned in the class to design and implement practical projects

Course Outcomes:

By the end of the course, the student will be able to:
1. Apply the basic MOS device physics and models to solve the given problem
2. Analyze and design single stage amplifiers
3. Analyze and design differential amplifiers
4. Analyze and design current sources/sinks/mirrors
5. Analyze and design basic operational amplifiers circuits

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	1	-	-	-	-	-	-	-	-	2	3	-	1
	2	3	2	2	-	-	-	-	-	-	-	-	1	3	-	1
	3	3	2	2	-	-	-	-	-	-	-	-	1	3	-	1
	4	3	2	1	-	-	-	-	-	-	-	-	1	3	-	1
	5	3	2	2	-	-	-	-	-	-	-	-	2	3	-	1

SYLLABUS

UNIT-I: **12 Periods**

Basic MOS Device Physics:

MOSFET as a switch, MOSFET structure and symbols, Threshold voltage, Derivation of I-V characteristics, second order effects.

UNIT-II: **12 Periods**

Device Modeling:

DC Models, Small signal models, use of device models in circuit analysis, DC MOSFET model, and small signal MOSFET model, High frequency MOSFET Model, Measurement of MOSFET Model parameters.

UN IT-III: **12 Periods**

Single stage amplifiers:

Basic concepts, CS stage with resistive load, CS stage with diode connected load, CS stage with Current-Source load, CS stage with Triode load, CS stage with Source degeneration, Source follower, Common gate stage, Cascode stage

UNIT-IV: **12 Periods**

Differential amplifiers:

Single ended and differential operation, qualitative and quantitative analysis of Basic differential pair, common mode response, differential pair with MOS Loads

Passive and Active current mirrors: Basic current mirrors, Cascode current mirrors, Active current mirrors.

UNIT-V: 12 Periods

Operational amplifiers:

Performance parameters, one stage op-amps, two stage op-amps, gain boosting, common mode feedback, input range limitations, slew rate, power supply rejection.

Text books:

1. Behzad Razavi , *Design of Analog CMOS Integrated Circuits,* Tata McGraw-Hill, 1st edition, 2002.
2. Randall Geiger, Phillip Allen, Noel Strader, *VLSI Design Techniques for Analog and Digital Circuits,* Tata McGraw-Hill, 1st edition, 2010.

References:

1. Douglas R. Holberg, P. E. Allen Phillip E. Allen, *CMOS Analog Circuit Design,* 2nd edition, 2002

ELECTROMAGNETIC INTERFERENCE / COMPATABILITY	
ECE 324(b)	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sectional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To Understand EMC regulation and methods of eliminating interferences.
- To understand methods of grounding of cable shield.
- To understand the concept of filtering and shielding.

Course Outcomes :

By the end of the course, students will be able to :
1. Apply the concept of EMI / EMC, related to product design & development.
2. Analyze the different EM coupling principles and its impact on performance of electronic system.
3. Analyze a system to confirm certain EMI standards.
4. Acquire knowledge of various EM radiation measurement techniques.
5. Model a given electromagnetic environment/system so as to comply with the standards.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2													3	
	2	3	2												3	
	3	3	2												3	
	4	3	2												3	
	5	3	2												3	

SYLLABUS

UNIT I **12 Periods**

Introduction to overview of EMI/EMC/ESD/EMP: EM environment, Historical Notes, Problems of EMI, Frequency Conservation, Assignment & spectrum, practical experiences, Occurrence of EMI, Concepts of EMI/EMC-definitions, Sources of noise, Natural and Nuclear Sources of EMI, Conducted and Radiated Emissions and Susceptibility. Introduction - EMI Testing and Compliance Tests, ESD, EMP.

UNIT II **12 Periods**

Elimination/Reduction Methodologies:

Grounding Techniques, Shielding Techniques, Electrical Bonding Techniques, Cabling Techniques, Power Supply Filters, Power Supplies, Connectors and Components/ Accessories.

UNIT III **12 Periods**

EMC Regulation/ Standards: Introduction to different commercial and defense Standards like FCC, CISPR/IEC, VDE, IEEE/ ANSI, MIL-STD

UNIT IV **12 Periods**

EMI/EMC Measurement Technologies: Introduction to various instruments used in the measurements and their characteristics, Radiated Interference Measurements, Conducted Interference Measurements, Pitfalls in EMI Measurements, Measurements of pulsed EMI, Introduction of Measurement Environment – OATS, Anechoic Chamber, TEM, GTEM cell. Software in EMI/EMC Measurements, Different EMI Test Instruments and their comparisons.

UNIT V **12 Periods**

EMI/EMC Modeling: Modeling of filter for suppression of EMI in the design, choice of various electronic components, Pulse Interference Immunity, EMC computer modeling and Simulation, Signal Integrity EMC design, Guidelines, Probabilistic

Text Book

1. IMPACT, *EMI/EMC for Engineering Colleges*, RSTE ,1997.
2. Kodali, V.P., "*Engineering EMC- Principles, Measurements, Technologies and Computer Models*", 2nd Ed., IEEE Press, NY, 2000.

Reference Books:

1. Paul, R.C, "*Introduction to EMC"*, 2nd Ed., John Wiley & Sons Inc., 2006.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	
ECE 324(c)	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To introduce the fundamentals of Electronic Instruments and Measurements providing an in-depth understanding of Measurement errors, Bridge measurements, Digital Storage Oscilloscope, function Generator and Analyzer, Display devices, Data acquisition systems and transducers.

Course Outcomes:

At the end of the course, the student will be able to:	
1.	Illustrate the operation of PMMC & EMMC and Measure various parameters with accuracy, precision and resolution.
2.	Illustrate the principle of operation, working of different electronic instruments
3.	Apply the knowledge of cathode ray oscilloscopes in various signal analyzing instruments
4.	Apply various bridge concepts for resistance measurement.
5.	Measure the physical phenomenon by selecting appropriate passive or active transducers.

Mapping of course outcomes with POs and PSO's:

		PO											PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	1	1										2		3
	2	1	1	2										2	1	2
	3	1	1	1										1	2	2
	4	2	2	2												2
	5	1	1	2										1	1	1

SYLLABUS

UNIT-I **[10 periods]**

Basic measurement concepts:

Objectives of engineering measurement, performance characteristics-static and dynamic. Errors in measurement, sources of error, types of errors, statistical analysis, classification of standards, permanent magnet moving coil(PMMC) meter, DC ammeter, DC voltmeter, voltmeter sensitivity, series ohmmeter, shunt ohmmeter, Electrodynamometer, problems

UNIT-II **[15 periods]**

Basic electronic instruments:

Instruments for measuring basic parameters-Amplified DC meter, AC voltmeter using rectifier, true RMS responding voltmeter, electronic multimeter, Q-meter, vector-impedance meter, vectorvoltmeter, rf and power measurement

Digital instruments: digital voltmeters and its different types-ramp, stair case ramp,integrating, continuous balance, successive approximation, resolution and sensitivity of digital meters, Digital multimeter, digital frequency meter, digital measurement of time, phase meter

UN IT-III **[15 periods]**

Oscilloscopes and signal analysis:

Introduction, ,oscilloscope block diagram cathode ray tube, crt circuits, vertical deflection system, delay line, horizontal deflection system, oscilloscope probes and transducers, Measurement of amplitude, time, frequency and phase (Lissajous method). Principle of sampling oscilloscope, digital storage oscilloscope

Signal analysis-basic wave analyzer, heterodyne wave analyzer, harmonic distortion analyzer, spectrum analyzer

UNIT-IV Bridge measurements: **[10 periods]**

Wheatstone bridge, Kelvin bridge, digital read-out bridges, microprocessor controlled bridge AC bridges: Measurement of inductance-Maxwell‟s bridge, hay bridge, Anderson Bridge. Measurement of capacitance- Schering Bridge, measurement of frequency-Wien bridge, wagners earth connection

UNIT-V **[10 periods]**

Transducers

Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples, and Thermistors), Velocity, Acceleration, vibration, pH measurement signal conditioning circuits, data acquisition systems, telemetry systems, IEEE 488 standard bus

Text Books:

1. A.D.Helfrick and W.D.Cooper, “modern Electronic Instrumentation and Measurement Techniques”, PHI, 5th edition, 2002
2. Electrical and Electronic Measurements and Instrumentation by A.K.Sawhney, 2002 edition

Reference Books:

1. H.S.Kalsi,”Electronic instrumentation”, second edition, TMH, 2004.
2. Oliver and Cage,”electronic measurements and instrumentation, TMH

TELECOMMUNICATION SWITCHING AND NETWORKS	
ECE 324(d)	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:

Digital Electronics, Signals and Systems, Electronic Circuit Analysis.

Course Objectives:

- To gain knowledge about the telecommunication industry: its services and market, the theoretical basis about performance (queuing theory) and operation (multiplexing, switching, routing, and signaling) in telecom networks.

Course Outcomes:

By the end of the Course, the students will be able to:	
1.	Apply the concepts of multiplexing and switching.
2.	Apply probability related concepts to resolve traffic and network related issues
3.	Analyze and solve problems in traffic engineering
4.	Acquire knowledge of ISDN and able to outline its architecture
5.	Acquire the knowledge of end to end transmission in data networks

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	2	1											3		
	2.	3	3											3		
	3.	3	3											3		
	4.	2												3		
	5.	2												2		

SYLLABUS

UNIT-I **10 Periods**

Telecommunication Switching Systems :

Basics of Switching Systems, Principles of Cross Bar Switching. Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Two Stage Networks, Three Stage Networks.

UNIT-II **10 Periods**

Time Division Switching :

Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching, Three Stage Combination Switching.

UNIT-III **20 Periods**

Telephone Networks :

Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Signaling Techniques: In Channel Signaling, Common Channel Signaling.

Traffic Engineering : Network Traffic Load And Parameters, Grade Of Service, Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems

UNIT-IV **10 Periods**

Integrated Services Digital Network (ISDN) :

Motivation For ISDN, Network & Protocol Architecture, Transmission Channels, User Network Interfaces, Numbering, Addressing, ISDN Standards, Broadband ISDN.

UNIT-V **15 Periods**

Data Networks :

Data transmission in PSTNs, Switching techniques for data transmission, Data communication architecture, Link-to-link layers, End-to-End layers, Local Area Networks, Metropolitan Area Networks, Data Network Standards, Protocol Stacks, Internetworking.

Text Book:

1. Thyagarajan Viswanath, "*Telecommunication Switching Systems and Networks*" PHI, 2000.

Reference Books:

1. J. Bellamy, "*Digital telephony*", 2nd edition, 2001, John Wiley.
2. B.A. Forouzan, "*Data Communication & Networking*", 3rd Edition, 2004, TMH.
3. J E Flood, "*Telecommunication switching, Traffic and Networks*", 2002, Pearson Education.

DIGITAL COMMUNICATIONS	
ECE 325	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:

Digital Electronics, Communication Systems, Electronic Circuit Analysis.

Course Objectives:

- To understand the basic building blocks of digital communication system and analyze the signal flow in such system.
- To analyze error performance of a digital communication system in presence of noise and other interferences
- To learn the concept of spread spectrum communication system
- To distinguish various error control coding techniques using the fundamental concepts of information theory.

Course Outcomes:

By the end of the Course, the student will be able to:	
1.	Compare and analyze various baseband and bandpass digital modulation techniques
2.	Calculate probability of error for various digital modulation techniques to analyze the performance of DCS in the presence of noise.
3.	Analyze the performance of spread spectrum code acquisition and tracking circuits.
4.	Determine the channel capacity and efficiency of various source encoding techniques.
5.	Implement channel coding techniques and comprehend error correction and detection.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	3	3	2											2	
	2.	3	3												3	
	3.	2	3	1											2	
	4.	3	3	1											2	
	5.	3	3	1									1		3	

SYLLABUS

UNIT-I **15 Periods**

Analog to Digital Conversion and transmission:

Analog to digital conversion- Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Noise in Pulse-Code and Delta-Modulation Systems; Digital modulation techniques- Binary Amplitude-Shift Keying, Binary Phase-Shift Keying, Differential Phase-Shift Keying, Quadrature Phase-Shift Keying (QPSK), M-ary PSK, Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift-Keying, M-ary FSK.

UNIT-II **15 Periods**

Data Reception:

A Base-band Signal Receiver, Probability of Error, The Optimum Filter, White Noise: The Matched Filter, Probability of Error of the Matched Filter, Coherent Reception: Correlation, Phase-Shift Keying, Frequency-Shift Keying, Non-coherent Detection of FSK, Differential PSK, QPSK, Error Probability for QPSK, MSK, Comparison of Modulation Systems.

UNIT-III **10 Periods**

Spread Spectrum Modulation: Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division Multiple Access(CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences, Acquisition (Coarse Synchronization) of a DS Signal, Tracking of a DS Signal.

UNIT-IV **10 Periods**

Information theory and coding: Concept of amount of information and its properties, Entropy and its properties, Information rate, mutual information and its properties; Source coding: Shannon‟s theorem, Shannon-Fano coding, Huffman coding, channel capacity of a Gaussian noise channel, bandwidth-S/N trade off.

UNIT-V **15 Periods**

Channel Coding: Linear Block Codes-Introduction, Matrix description of Linear block codes, cyclic codes, Error detection and error correction capabilities of linear block codes, Hamming codes; Convolution Codes-encoding of convolution codes, Graphical approach: state, tree and trellis diagram.

Text Books:

1. H.Taub and D.Schilling, "*Principles of Communication Systems*"- TMH, 2003.
2. P.Ramakrishnarao, "*Digital Communication*" – Mc,Graw Hill editon, 2011.

Reference Books

1. Simon Haykin, "*Digital communications*"- John Wiley, 2005.
2. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," (2nd Edition).
3. K.Samshanmugam, "*Digital and Analog Communication Systems*" - John Wiley, 2005.

COMMUNICATION SYSTEMS ENGINEERING LABORATORY	
ECE 326	**CREDITS: 2**
Practical: 3 Periods/Week	Sessional Marks: 50
End Exam : 3 Hours	End Exam Marks: 50

Prerequisites:

Communication Systems, Signals and Systems, Electronic Circuit Analysis.

Course Objectives:

- To understand basic theories of analog communication system to design and implement analog modulator and demodulator
- To understand the applications of analog modulator and demodulator circuits, and to investigate signals in time and frequency domain.

Course Outcomes:

By the end of the Course, the student will be able to:	
1.	Apply the different modulation techniques in the design of communication system.
2.	Design the FM system and analyze its performance.
3.	Design analog pulse modulator and demodulators
4.	Measure the parameters of Super Heterodyne Radio Receiver.
5.	Simulate different functional blocks of analog communication system.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

SYLLABUS

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	2		2	1				1	1	1				3	
	2.	3		3	1				1	1	1				3	
	3.	2		3	1				1	1	1				3	
	4.	2		2	1				1	1	1				3	
	5.	2		2	2	3			1	1	1				3	

TRAINER KIT BASED EXPERIMENTS

1) Amplitude Modulation & Demodulation
2) Frequency Modulation & Demodulation
3) Balanced Modulator
4) Analog Time Division Multiplexing
5) Base band Sampling
6) Pulse Amplitude Modulation & Demodulation
7) Pulse Time Modulation & Demodulation
8) SSB-SC-AM Modulation
9) Super Hetero dyne Radio Receiver Parameters
10) Spectral Analyses of AM using Spectrum Analyzer
11) Spectral Analyses of FM using Spectrum Analyzer

SIMULATION BASED EXPERIMENTS(Open source/ Matlab /Multisim)

1) Amplitude Modulation & Demodulation
2) Frequency Modulation & Demodulation
3) Balanced Modulator

4) SSB-SC-AM Modulation
5) Pulse Time Modulation &Demodulation
6) Pr-emphasis & De-emphasis
7) Passive Filter Design
8) Attenuator
9) Twin T Network
10) Envelope Detector
11) Frequency Mixer/IF Amplifier/Automatic Gain Control

A student has to perform minimum of 10 experiments.

Text Books

1. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," 2nd Edition, Oxford University Press, 2010.
2. Simon Haykins, "*Communication Systems*," Wiley, Fifth edition, 2009.
3. P.Ramakrishna Rao, "*Analog communications*" Tata McGraw Hill Education Private Limited. 2011.

MICROCONTROLLER & EMBEDDED SYSTEMS LABORATORY	
ECE327	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:

Microprocessors and Interfacing, Microcontroller & Embedded Systems

Course Objectives:

- To program 8051 to meet the requirements of the user.
- To interface various peripherals
- To handle interrupts
- To design a microcomputer to meet the requirement of the user

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Program 8051 microcontroller to meet the requirements of the user.
2.	Interface peripherals like switches, LEDs, stepper motor, Traffic lights controller, etc..,
3.	Apply concept & types of interrupts for the given context.
4.	Design a microcontroller development board to meet the requirements of the user

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	2	2	3			1	1	1				2	2
	2	3	2	2	2	3			1	1	1				3	2
	3	3	2	2	2	3			1	1	1				2	2
	4	3	2	2	2	3	2		1	1	1	1			3	3

List of Experiments:

1. Study and familiarization of 8051 Microcontroller trainer kit
2. Assembly Language Program for addition of 8-bit numbers stored in an array
3. Assembly Language Program for Multiplication by successive addition of two 8-bit numbers
4. Assembly Language Program for finding largest no. from a given array of 8-bit numbers
5. Assembly Language program to arrange 8-bit numbers stored in an array in ascending order
6. Stepper motor control by 8051 Microcontroller
7. Interfacing of 8-bit ADC 0809 with 8051 Microcontroller
8. Interfacing of 8-bit DAC 0800 with 8051 Microcontroller and Waveform generation using DAC
9. Implementation of Serial Communication by using 8051 serial ports
10. Assembly Language Program for use of Timer/Counter for various applications
11. Traffic light controller/Real-time clock display
12. Simple test program using ARM 9 mini 2440 kit (Interfacing LED with ARM 9 mini 2440 kit)

NOTE:

1. It is compulsory for each student to Design/Create their own Microcontroller Development Board for personal use
2. A student has to perform a minimum of 10 experiments.

Text Books:

1. Muhammed Ali Mazidi, Janice GillispieMazidi, Rolin D Mc Kinlay , *The 8051 Microcontroller and Embedded Systems Using Assembly and C*, 2nd Edition, Pearson Education, 2008.

2. Frank Vahid, Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley.
3. Rajeshwar Singh, Dr.D.K.Singh, *Embedded System Design,* 1st Ed., Dhanpat Rai, 2010

SOFT SKILLS LAB	
ECE328	**Credits : 02**
Instruction: 3Periods/week	Sessional Marks: 100

Prerequisites:

Basic English language skills- LSRW, English theory, English Language Lab.

Course Objectives:

- To equip students with required skills such as interpersonal skills, communication skills, leadership skills etc.
- To train students on employability skills to win in the job interviews and building confidence to handle professional tasks.

Course Outcomes:

By the end of the course, the student will be able to:	
1	Comprehend the core engineering subjects using effective verbal and nonverbal communication skills.
2	Present accurate and relevant information efficiently, using suitable material aids.
3	Work effectively as an individual as well in teams and emerge as responsible leaders with appropriate professional ethics.
4	Participate in group discussions and interviews using analytical and problem solving abilities, which enhance their employability skills.
5	Set time bound goals and realize them through strategic plans for successful career.

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1O**	**11**	**12**	**1**	**2**	**3**
CO	**1**				2			1								2
	2										3					1
	3								2	3						3
	4						2									3
	5															3

SYLLABUS

UNIT-I : **9 Periods**

Art of communication

1. Definition of Communication
2. Types of Communication
3. Non-verbal Communication
4. Listening skills
5. Feed back

D.A. - Practice of proper hand shake, practice of different postures and gestures andactivity on giving feedback

UNIT- II: **6 Periods**

Presentation Skills

Purpose

1. Effective presentation strategies
2. Analysis of audience
3. Preparing an outline of the presentation,
4. Audio –visual aids
5. Body language**.**

D.A. -Group presentation by each team

UNIT- III : **9 Periods**

Group Discussions Introduction- as a part of selection process-guidelines for GD

1. Types of GD
2. Nature of topics of G.D
3. Roles to be played by participants in a GD
4. Evaluation process

D.A–Group discussions

UNIT – IV: **6 Periods**

Team Building and Leadership

1. Importance of team work
2. Different stages of team formation
3. Good team vs. effective team
4. Team player and Team leader
5. Types of leadership
6. Decision making and negotiating skills

D.A-Decision making for a given situation

UNIT –V: **3 Periods**

Time- Management

1. Importance of time-management
2. Time-Management models
3. Prioritization
4. The art of saying „No"
5. Identifying Time Wasters

D.A -Time- Bound activities devised by the facilitator

UNIT- VI: **3 Periods**

Goal-Setting

Different type of Goals (Immediate and Short term)

1. „SMART" Goals
2. Strategies to achieve goals

D.A - Prepare a chart of immediate, short term and long term goals

UNIT- VII: **9 Periods**

Job- Interviews

Preparing Resumes and C.V"s

1. Preparing for the interview
2. FAQ"s (Integrity, Stress management, Close- Ask questions)

D.A –Mock interviews

REFERENCE BOOKS:

1. Sanjay Kumar and Pushpalata, *Communication Skills* ,Oxford University Press , 2011.
2. Allan Pease, *Body Language***,** Sheldon Press,1997.
3. John A. Kline and BhavnaBhalla, *Speaking Effectively; Achieving Excellence in Presentations*, Pearson publication, 2013.
4. Marc Mancini, *Time Management*, Tata McGraw Hill publishing Comp.Ltd.,2003.
5. Peter Veruki, *The 250 Job Interview Questions,*Adams Media Corporation Avon, Massachusetts,1999.

QUANTITATIVE APTITUDE - II	
ECE 329	**Credits: 2**
Instructions: 4 Periods/week	Sessional Marks: 100

Prerequisites: Nil

Course Objectives:

- To enhance the problem solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of competitive examinations.

Course Outcomes:

Quantitative Aptitude –II

By the end of the course student will be able to :	
1.	Use their logical thinking and analytical abilities to solve reasoning questions from company specific and other competitive tests.
2.	Solve questions related to permutation & combinations and probabilities from company specific and other competitive tests.
3.	Understand and solve puzzle related questions from specific and other competitive tests.

Verbal Aptitude-II:

By the end of the course student will be able to :	
1.	Write paragraphs on a particular topic, essays (issues and arguments), e mails, summaries of group discussions, make notes, statement of purpose (for admission into foreign universities), letters of recommendation (for professional and educational purposes)
2.	Converse with ease during interactive sessions/seminars in their classrooms, compete in literary activities like elocution, debates etc., raise doubts in class, participate in JAM sessions/versant tests with confidence and convey oral information in a professional manner using reason.
3.	Prepare his/her resume, apply the business English concepts learnt in the course, and refine one‟s overall demeanor which would be very essential to face the corporate world
4.	Respond to their interviewer/employer with a positive mind, customize answers to the questions asked during their technical/personal interviews, exhibit skills required for the different kinds of interviews (stress, technical, HR) that they would face during the course of their recruitment process

SYLLABUS

Section –A (Quantitative Aptitude –II)

UNIT I8
Periods
Numerical
Reasoning:

Problems related to Number series, Analogy of numbers, Classification of numbers, Letter series,Seating arrangements, Directions, blood relations and puzzle test.

UNIT
II4
Periods
Combin
atorics:

Counting techniques, Permutations, Combinations and Probability

UNIT III4 Periods
Data sufficiency
Syllogisms

UNIT IV **4 Periods**
Application of Base system:
Clocks (Base 24), Calendars (Base7), Cutting of Cubes and cuboids

UNIT V **4 Periods**
Puzzle Solving & Time Management using various problems solving tools and techniques:

Selective puzzles from previous year placement papers
Selective puzzles from book Puzzles to puzzle you by shakunataladevi
Selective puzzles from book more puzzles by shakunataladevi
Selective puzzles from book puzzles by George summers

Books for practice
1. Quantitative aptitude by RS Agarwal, S Chand Publications
2. Verbal and non verbal Reasoning by RS Agarwal from S Chand publications
3. Puzzles to puzzle you by shakunataladevi orient paper back publication
4. More puzzles by shakunataladevi orient paper back publication
5. Puzzles by George summers orient paper back publication.

References:

1. Barron‟s by Sharon Welner Green and Ira K Wolf (Galgotia Publications pvt. Ltd.)
2. Material from „IMS, Career Launcher and Time‟ institutes for competitive exams.
3. Reasoning by BS SijwaliArihant publications
4. Reasoning Arun Sharma McGrawhill publications

Websites:
1. www.m4maths.com
2. www.Indiabix.com
3. 800score
4. Official GRE site
5. Official GMAT site

Section –B (Verbal Aptitude –II)

UNIT I **4 Periods**
General Essay writing, writing Issues and Arguments(with emphasis on creativity and analysis of a topic), paragraph

writing, story writing, guidance in framing a „Statement of purpose‟, „Letters of Recommendation‟, business letter writing, email writing, email and business letter writing etiquette, letters of complaints/responses to complaints. Information transfer is taught with the

help of tables, bar diagrams, and pie charts while framing /sending lengthy data where testing is done through Reading comprehension and Critical reasoning. Contextual meanings with regard to inflections of a word, frequently confused words, words often mis-used, words often mis-spelt, multiple meanings of the same word (differentiating between meanings with the help of the given context), foreign phrases. Enhanced difficulty level in spotting errors will be taken up with reference to competitive test based exercises.

UNIT II **4 Periods**

Just a minute sessions, reading news clippings in the class, extempore speech, telephone etiquette, making requests/suggestions/complaints, elocutions, debates, describing incidents and developing positive non verbal communication. Analogies, YES-NO statements (sticking to a particular line of reasoning)

UNIT III **4 Periods**

Corporate readiness, business idioms and expressions, reading newspapers/magazines, brushing up on general awareness, latest trends in their respective branches, resume preparation, understanding business /corporate language, managing emotions, problem solving, importance of team work, goal orientation, professional grooming, positive attitude, assertiveness and inter personal skills.Data sufficiency (answering questions within the ambit of the given text), Fact-Inference-Judgment (to identify statements as FIJ), Syllogisms (with emphasis on fallacies in reasoning), strong and weak arguments.

UNIT IV **6 Periods**

Voice, direct & indirect speech, question tags, one word substitutes, and foreign phrases. An overview on group discussions, preparation for a group discussion, intricacies of a group discussion, topics for GDs (with special focus on controversial topics), structure of participation in a group discussion, roles played by the participants in a group discussion, constructive criticism, standard procedures followed whilst participating in a group discussion, frameworks that can be used for discussion, analysis of the discussion and exposure to case-based group discussions.

UNIT V6 Periods

Different types of interviews (with emphasis on personal interview), preparation for an interview, areas of questioning, answering questions on general traits like strengths/weaknesses/hobbies/extracurricular activities, choosing role models, importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews, handling stress, suggestions for responding to tough/unknown questions, preparation on self and personality development.

Note: The concepts learnt in Semester I will be tested in the Mid-term and Semester end exams during the II Semester as well.

Reading/ Listening material:

1. Newspapers like „The Hindu", „Times of India", „Economic Times".
2. Magazines like Frontline, Outlook and Business India.
3. News channels NDTV, National News, CNN

References:

1. Books written by Stephen Covey and Dale Carnegie-Seven Habits of Highly Effective People etc-Simon & Schuster, Running Press book publishers
2. Books written by Bertrand Russell-Oxford University Press

Suggested General Reading

1. **Who Moved My Cheese?** By Spencer Johnson-GP Putnam‟s Sons
2. **The art of War**-Sun Tzu by Nabla, Barnes & Noble
3. **The Monk Who Sold Ferrari**-Robin Sharma by Harper Collins, Jaico Publishers
4. **The Hobbit** and other books by JRR Tolkein-Harper Collins

Suggested Authors

1. illiam Dalrymple
2. V.S.Naipaul
3. Kushwanth Singh
4. Ernest Hemingway
5. Charles Dickens
6. Leo Tolstoy
7. R.K. Narayan
8. Amitav Ghosh
9. Oscar Wilde

FOURTH YEAR SYLLABI

I - Semester

&

II - Semester

Fourth Year I - Semester

Code	Subject name	Instruction periods per week					Max marks		Credit s
		Cat	L	T	P	Total	Sessional	End marks	
ECE411	Engineering Economics and Management	HS	3	1	-	4	40	60	3
ECE412	Computer Network Engineering	PC	3	1	-	4	40	60	3
ECE413	Open Elective-II	OE	3	1	-	4	40	60	3
ECE414	Professional Elective -II	PE	3	1	-	4	40	60	3
ECE415	VLSI Design	PC	3	1	-	4	40	60	3
ECE416	Elective Lab	PC	-	-	3	3	50	50	2
ECE417	Digital Communications Laboratory	PC	-	-	3	3	50	50	2
ECE418	Industrial Training Seminar	IT	-	2	2	4	100	-	4
ECE419	Project Phase – I	PW	-	-	8	8	100	-	4
Total			15	7	16	38	500	400	27

Professional Elective-II

1. Advanced Digital Signal Processing
2. Radar Signal Processing
3. Digital IC design using HDL
4. Digital Image Processing

Open Elective-II: (for ECE, offered other departments)

1. Project management
2. Industrial Safety and Hazards Management
3. IT infrastructure and management
4. Multimedia concepts 5.E-Governance
7. Robotics 7.Power Electronics

Elective Lab

1. VLSI
2. Signal and image processing
3. Virtual instrumentation
4. Antenna Design

Fourth Year II - Semester

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE421	Cellular and Mobile Communications	PC	3	1	-	4	40	60	3
ECE422	Professional Elective-III	PE	4	1	-	5	40	60	4
ECE423	Professional Elective-IV	PE	4	1	-	5	40	60	4
ECE424	Microwave Engineering Laboratory	PC	-	-	3	3	50	50	2
ECE425	Project Phase - II & Dissertation	PW	-	-	16	16	100	100	8
ECE426	Massive Open Online Course (MOOC)	OE	-	-	-	-	100	-	2
Total			11	3	19	33	270	330	23

Professional Elective-III

1. Phased array systems
2. Bio-medical Instrumentation
3. Optical communications
4. Embedded and Real Time Systems

Professional Elective-IV

1. Satellite Communications & GPS
2. VLSI Signal processing
3. Wireless sensor networks
4. Cognitive Radio Networks

ENGINEERING ECONOMICS AND MANAGEMENT

ECE 411 **Credits:3**

Instruction: 3 Periods & 1 Tut/week Sessional Marks:40

End Exam: 3 Hours End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To understand the importance of economics and management in engineering
- To understand in managerial decision making.
- To provide basic principles to state-of-the-art concepts and applications.

Course Outcomes:

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

1. Use the concepts of Economics.
2. Manage the organizations effectively and to relate the concepts of management with industrial organizations and manage organizationsefficiently.
3. Acquire the knowledgeof production management and make decisions proficiently.
4. Acquire the knowledgeof accounting, finance and marketing management.

CO-PO –PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								2	3		2	1
CO2								2	3		2	1
CO3								2	3		2	1
CO4								2	3		2	1

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Fundamentals of Economics: Wealth, Welfare and Scarce Definitions of Economics; Micro and Macro Economics; Demand- Law of Demand, Elasticity of Demand, Types of Elasticity and Factors determining price elasticity of Demand: Utility- Law of Diminishing Marginal Utility, its limitations and exceptions.

UNIT II 10 Periods

Forms of Business Organizations: Features, merits and demerits of Sole Proprietorship, Partnership and Joint Stock Company- Public Enterprises and their types.

UNIT III 20 Periods

Introduction to Management: Functions of Management- Taylor‟s Scientific Management; Henry Fayol‟s Principles of Management;

Human Resource Management –Basic functions of Human Resource Management (in brief).

Production Management: Production Planning and Control, Plant Location, Break-Even Analysis- Assumptions, limitations and applications.

UNIT IV 10 Periods

Financial Management: Types of Capital: Fixed and Working Capital and Methods of Raining Finance; Final Accounts- Trading Account, Statement of Profit and Loss and Balance Sheet (simple problems)

UNIT V 10 Periods

Marketing Management and Entrepreneurship: Marketing Management: Functions of marketing and Distribution Channels. **Entrepreneurship**:Definition, Characteristics and Functions of an Entrepreneur

TEXT BOOKS:

1.A.R. AryaSri, Managerial Economics and Financial Analysis, TMH Publications, new Delhi, 2014**(UNIT–I,II,IV &V)**

2.S.C. Sharma and Banga T. R., Industrial Organization & Engineering Economics,khanna Publications, Delhi-6, 2006**(UNIT– III &IV)**

3.S.N.Maheswari, SK Maheswari, Financial Accounting Fifth Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012 **(UNIT-V)**

COMPUTER NETWORK ENGINEERING

ECE 412 **Credits:3**

Instruction: 3 Periods & 1 Tut/week Sessional Marks:40

End Exam: 3 Hours End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To develop an understanding of computer networking basics.
- To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.

Course Outcomes:

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

1. Applythe concepts of Computer Networks and Networks Models for Data Communication.
2. Analyze networking architecture and infrastructure for wired and wireless link
3. Design, calculate, and apply subnet masks and routing addresses to fulfill networkingrequirements
4. Analyze issues of routing and congestion mechanism for independent and internetworkingnetworks for wired and wireless link.
5. Analyze internal workings of the Internet and of a number of common Internet applicationsand protocols (DNS, SMTP, FTP, HTTP, WWW, Security and Cryptography).

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1													2	2	
CO2		2											1	2	
CO3		2	3										2	2	
CO4	1	2											2	2	
CO5		2	3										2	2	

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences

UNIT II 10 Periods

Data Link Layer: Error – detection and correction – Parity – LRC – CRC – Hamming code – Low Control and Error control - Stop and Wait – go back-N ARQ – Selective Repeat ARQ- Sliding window – HDLC. - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges.

UNIT III 10 Periods

Network Layer: Internetworks – Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNIT IV 10 Periods

Transport Layer: Duties of transport layer – Multiplexing – De-multiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

UNIT V 10 Periods

Application Layer: Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW – Security – Cryptography.

TEXT BOOKS:

1. William Stallings, "Data and Computer Communication", Sixth Edition, Pearson Education, New Delhi, 2000. **[UNIT- I,II &III]**
2. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition PHI Learning, New Delhi, 2003.**[UNIT- IV &V]**

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw- Hill Publishing Co. Pvt., Ltd., New Delhi, 2006.
2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, New Delhi, 2003.

ADVANCED DIGITAL SIGNAL PROCESSING

ECE 414(a) **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Signals and Systems (ECE 214), Digital Signal Processing (ECE 322)

Course Objectives:

- To introduce decimation and interpolation of discrete time signals
- To understand design of digital system with different sampling rates
- To understand the various linear filters
- To learn various adaptive algorithms for different applications and analyze methods of power spectrum estimation.

Course Outcomes:

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

1.	Analyze decimation and interpolation of discrete-time signals.
2.	Design a digital system with different sampling rates.
3.	Analyze the properties of various linear filters.
4.	Apply and analyze various adaptive algorithms for different applications.
5.	Analyze the parametric and non-parametric methods of power spectrum estimation.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3		-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2		-	-	-	-	-	-	-	-	-	2	-	-
CO4	2	2		-	-	-	-	-	-	-	-	-	2	-	-
CO5	2	3		-	-	-	-	-	-	-	-	-	2	-	-

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Multi Rate Digital Signal Processing

Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion **Applications of Multi Rate Signal Processing:** Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Sub-band Coding of Speech Signals.

UNIT II10Periods

Linear Prediction and Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations, The Goertzel algorithm, the chirp – z transform algorithm, the Schur algorithm

UNIT III10Periods

Adaptive filters: Applications- Adaptive noise cancelling, adaptive channel equalization, echo cancellation in data transmission over telephone channels. LMS algorithm, properties of LMS algorithm, RLS algorithm, fast RLS algorithms and properties of the RLS algorithms.

UNIT IV 10Periods

Non-Parametric Methods of Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods

UNIT V 10 Periods

Parametric Methods of Power Spectrum Estimation& DSP Processors: Autocorrelation &Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.

TEXT BOOKS:

1. S. M .Kay, Modern Spectral Estimation: Theory & Application, PHI, 1988. (**UNIT- I, II, III, IV, V)**

2. J.G.Proakis& D. G. Manolakis, Digital Signal Processing: Principles, Algorithms &Applications 4th Ed., PHI.

REFERENCE BOOKS:

1. Theory and applications of digital signal processing by Lawrence R. Rabiner and Bernard Gold, PHI.
2. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata McGraw-Hill, 1998
3. P.P.Vaidyanathan, Multi Rate Systems and Filter Banks , Pearson Education.

RADAR SIGNAL PROCESSING

ECE 414(b) **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Antennas and wave propagation (ECE 316),Microwave and radar engineering(ECE 321)

Course Objectives:

- To illustrate the principles of Radar Systems and Signal Processing techniques.
- To analyze and detect the radar signals in presence of noise.
- To explore about the radar waveforms
- To acquire knowledge about pulse compression Radar.

Course Outcomes:

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

1.	Apply the principles of CW and FM radar
2.	Analyze the time, frequency and signal processing aspects of pulse Doppler radar
3.	Represent the design aspects of radar waveforms including matched filtering
4.	Analyze pulse burst waveform and frequency modulated pulse compression waveforms
5.	Illustrate the principles of synthetic aperture radar

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3		-	-	-	-	-	-	-	-		2	-	-
CO2	2	3		-	-	-	-	-	-	-	-		2	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-		2	-	-
CO4	2	2		-	-	-	-	-	-	-	-		2	-	-
CO5	1	2		-	-	-	-	-	-	-	-		2	-	-

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

CW and FM radar: The Doppler effect, CW radar, frequency modulated CW radar, airborne Doppler navigation, multiple frequency CW radar

UNIT II 10 Periods

MTI and pulse Doppler radar: Introduction, Delay line cancelers, multiple or staggered pulse repetition frequencies, range gated Doppler filters, digital signal processing, other MTI delay lines, example of an MTI radar processor

UNIT III 10 Periods

Waveform matched filter: The matched filter, matched filter for the simple pulse, all-range matched filtering, straddle loss, range resolution of the matched filter. Matched filtering for moving targets.

The ambiguity function: definition and properties of the ambiguity function, ambiguity function of the simple pulse

UNIT IV 10 Periods

The pulse burst waveform: matched filtering for the pulse burst waveform, pulse-by-pulse processing, range ambiguity, Doppler response for the pulse burst waveform, the slow-time spectrum and the periodic ambiguity function

Frequency modulated pulse compression waveforms: linear frequency modulation, the principle of stationary pulse, ambiguity function of the LFM waveform, range-Doppler coupling, stretch processing

UNIT V 10 Periods

Synthetic Aperture Radar: Basic block diagram of a typical SAR radar, introduction, constraint and resolution swath, radar equation for SAR, equipment consideration, optinal processing, digital processing, Doppler-frequency model, range resolution, other aspects of SAR, introduction to inverse SAR

TEXT BOOKS:

1. Merill I. Skolnik, "Introduction to radar systems," Tata McGraw-Hill, 2007 (**UNITS- I,II &V)**
2. Mark A. Richards, "Fundementals of radar signal processing," Tata Mc-Graw-Hill Educations, 2005 **(UNITS- III &IV)**

REFERENCE BOOKS:

1. Canner Ozedemir, "Inverse synthetic aperture radar imaging with MATLAB algorithms," Vol 210., John Wiley & Sons, 2012

DIGITAL IC DESIGN USING HDL

ECE 414(c) **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Digital Electronics, Computer Architecture & Organization, Integrated Circuitsand Applications

Course Objectives:

- Learn EDA tools and VLSI designs
- Outline the tools and model the digital blocks
- Build and model digital circuits
- Understand the system level design and related concepts.
- Implement CMOS circuits
- Learn drawing SM charts and apply timing parameters

Course Outcomes:

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

1.	Interpret the importance of EDA tools and its flow for VLSI designs
2.	Model logic gates ,half adder, full adder ,various digital blocks by using modern toolswith HDL
3.	Construct verilog HDL models for combinational and sequential circuits using gate level, behavioral level and dataflow level
4.	Build CMOS circuits using Verilog switch level programming
5.	Apply design rule checks and timing parameters to digital circuits and model the state machines

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										1		2
CO2	1	1	3										1		2
CO3	2	2	1												3
CO4	1	2	2												3
CO5	2	1	3									1			3

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction to Electronic Design Automation: Introduction, FPGA Design flow, ASIC Design flow, architectural design, logic design, Physical design of IC. Simulation, verification and testing. EDA Tools: FPGA Design, ASIC Design.

FPGA Based Front End Design-Implementation, FPGA configuration, User constraints Xilinx 3000 Series FPGA architecture, ALTERA FLEX 10K Series CPLD architecture

UNIT II 10 Periods

Verilog Language Constructs: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools, Test Benches. Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks, Exercises

UNIT III 10 Periods

Gate level Modeling and Dataflow Modeling: AND Gate Primitive, Module Structure, Other Gate Primitives, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flip-flops with Gate Primitives, Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits, Exercises .Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

UNIT IV 10 Periods

Behavioraland Switch Level Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Examples, Assignments with Delays, Wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-blocking Assignments, The case statement, Simulation Flow. i*f*andi*f*-else constructs, repeat construct, for loop, , while loop, forever loop, parallel blocks, force-release construct, Event. Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Trireg Nets, Exercises

UNIT V 10 Periods

System Tasks, Functions, UDP and SM Charts: Introduction, Parameters, Path Delays, Module Parameters, System Tasks and Functions. File Based Tasks and Functions, Compiler Directives, Hierarchical Access, General observations, Exercises.

User-Defined Functions, Tasks and Primitives-Introduction, Function, Tasks, User- Defined Primitives (UDP), FSM Design (Moore and Mealy Machines), State Machine Charts, Derivation of SM Charts, Realization of SM Charts, Examples based on SM charts

TEXT BOOKS:

1. T.R. Padmanabhan and B. Bala Tripura Sundari," Design through Verilog HDL" WSE, IEEE Press, 2004**(UNIT-I,II,III,IV &V)**
2. J. Bhaskar" A Verilog Primier" ,First edition ,BSP, 2003**(UNIT-I,II,III,IV &V)**

REFERENCE BOOKS:

1. Brown and ZvonkoVranesic Stephen" Fundamentals of Logic Design with Verilog "TMH, 2005.
2. Michael D. Ciletti "Advanced Digital Design with Verilog HDL ",Second edition, PHI, 2005.

DIGITAL IMAGE PROCESSING

ECE 414(d) **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Signal & System (ECE 214), Digital Signal Processing (ECE 322)

Course Objectives:

- To study the image fundamentals and mathematical transforms necessary for image processing. To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.

Course Outcomes:

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

1.	Illustrate the basic components of digital image processing system and transform techniques (FFT, DCT and Hadamard transform).
2.	Analyze image enhancement in spatial domain using smoothing and sharpening operators.
3.	Analyze image enhancement in frequency domain using High pass and low pass filters.
4.	Apply Weiner filtering for image restoration, thresholding and region growing techniques for image segmentation.
5.	Compare and contrast image compression techniques (Variable length coding, LZW coding, Bit plane coding, Lossless predictive coding, Lossy prediction, transform coding).

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2											2		
CO2	2	2	1										2		
CO3	2	2	1										2		
CO4	2	1	1									1	2		
CO5	2	2										1	2		

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Digital Image Fundamentals: Fundamental steps in digital image processing, Components of an image processing system, Elements of visual perception, Image sensing and acquisition, Image sampling and quantization, Basic relationship between pixels

Image Transforms: Two-dimensional FFT properties, Discrete cosine transform &Hardmard transform

UNIT II 10 Periods

Image Enhancement (Spatial Domain): Introduction, Basic gray level transformation, Histogram processing, Enhancement using arithmetic/logic operations, Basics of spatial filtering: Smoothing and sharpening spatial filter

UNIT III 10 Periods

Image Enhancement (Frequency Domain): Introduction to Fourier transform and the frequency domain, Smoothing and sharpening frequency domain filters, Homomorphic filtering

UNIT IV 10 Periods

Image Restoration: Introductionto image degradation, Noise model, Restoration in presence of noise only, Inverse filtering, Wiener filtering,

Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding (global and adaptive), Region based segmentation

UNIT V 10 Periods

Image Compression: Redundancy, Fidelity criteria, Image compression models, Error free compression: Variable length coding, LZW coding, Bit plane coding, Lossless predictive coding, Lossy prediction, transform coding, image compression standards

Fundamentals of morphological processing - Dilation, Erosion, Opening, Closing

TEXT BOOKS:

1. TRafael C Gonzalez, Richard E Woods, "Digital Image Processing," PHI, Second edition, 2004. **(UNITS I, II, III, IV, V)**
2. Jayaraman S, Esakkirajan S, Veerakumar T, "Digital Image Processing," Tata McGraw Hill, 2010 **(UNIT-I)**

REFERENCE BOOKS:

1. Anil Kumar Jain, "Fundamentals of Digital Image Processing," PHI, 2002.

VLSI DESIGN

ECE 415 **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Digital Electronics, ECA-I, ECA-II, IC analysis

Course Objectives:

- To Make the students understand different electrical properties of CMOS devices.
- To Familiarize the students with IC Production and fabrication processes for NMOS, PMOS, BiCMOS Technologies.
- To introduce stick diagrams, layout preparation for CMOS circuits and compute delays of CMOS circuits.
- To Acquaint the students with circuit design processes with different levels of testing and scaling.
- Description about NMOS, CMOS combinational and sequential logic at the transistor level, including mask layout.
- To introduce digital design at circuit and gate level.

Course Outcomes:

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

1.	Delineate IC Production process, fabrication processes for NMOS, PMOS, BiCMOS Technologies.
2.	Analyze CMOS electrical properties with circuit concepts.
3.	Draw stick diagrams, layouts for CMOS circuits and compute delays of CMOS circuits.
4.	Analyze the gate level and system level CMOS digital design.
5.	Apply testing methods on the digital designs for DFT.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2													2
CO2	2	2	2												1
CO3	2	2	2												1
CO4	2	2	1									1			1
CO5	2	1	2				1				1	1			2

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

IC Technology: MOS, PMOS, NMOS, CMOS &BiCMOS technologies- Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Integrated Resistors and Capacitors.

UNIT II 10 Periods

CMOS Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Basic circuit concepts:

Sheet Resistance R_S and its concept to MOS, Area Capacitance Units, Calculations - Delays, driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers

UNIT III 10 Periods

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 micron CMOS Design rules, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT IV 10 Periods

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits. Different CMOS logic Circuits-Pseudo, Dynamic, Domino, C^2MOS.

Subsystem Design: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators.

UNIT V 10 Periods

VLSI Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques, Design for testability, Practical design for test guidelines, Buil-In-Self-Test

TEXT BOOKS:

1. Douglas A, Pucknell, Kamran Eshraghian,"Basic VLSI Design",3rd Edition,Prentice Hall, l996.**(UNITS I, II, III, IV & V)**
2. Weste and Eshraghian, "Principles of CMOS VLSI Design", Pearson Education, 1999

REFERENCE BOOKS:

1. John .P. Uyemura,"Introduction to VLSI Circuits and Systems",JohnWiley, 2003.
2. Wayne Wolf, "Modern VLSI Design", 3rd Edition, Pearson Education, 1997

VLSI LAB

ECE 416(a) **Credits:2**

Instruction: 3 Practical‟s /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites: Digital Electronics, VHDL, Verilog

Course Objectives:

- To Apply the concepts of basic combinational logic circuits and sequential circuit elements in the laboratory setting.
- To develop familiarity and confidence with designing, building and testing digital circuits, using Xilinx VLSI design tools.
- To familiarize with the working knowledge of Artix 7 PFGA development board

Course Outcomes:

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

1.	Analyze the digital circuits using XILINX VLSI design tools.
2.	Develop the systems for various signal processing and computing applications
3.	Test and verify the prototypes at system level using XILINX Vivado simulators.
4.	Analyze and Develop the prototypes of Digital systems on Artix 7 FPGA.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	2	3	-	-	-	-	-		1	2	2	2
CO2	3	2	2	2	3	-	-	-	-	-		1	2	3	2
CO3	3	2	2	2	3	-	-	-	-	-		1	2	2	2
CO4	3	2	3	3	3	-	-	-	-	-		1	3	3	3

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

CYCLE I- Digital Design using HDL

Experiment 1: Static Display
Experiment 2: Frequency Divider
Experiment 3: Traffic Light Controller
Experiment 4: Design of Memories

CYCLE IIFPGA prototyping using Artix 7

Experiment 1: Familiarization with Artix 7 FPGA
Experiment 2: Implementation of Adders on Artix 7 FPGA using Verilog
Experiment 3: Implementation of Multipliers on Artix 7 FPGA using Verilog
Experiment 4: Implementation of Moore and Mealy FSM on Artix 7 FPGA using Verilog
Experiment 5: Implementation of ALU on Artix 7 FPGA
Experiment 6: Implementation of 8 bit MAC on Artix 7 FPGA

TEXT BOOKS:

1. JayaramBhasker, “A Verilog Primer”, AT&T, Prentice Hall
2. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design And Synthesis”, SunSoft Press1996

REFERENCE BOOKS:

1. ZainalabedinNavabi, “Verilog Digital System Design”, 2nd Edition, McGraw-Hill, 2006

SIGNAL AND IMAGE PROCESSING LAB

ECE 416(b) **Credits:2**

Instruction: 3 Practical‟s /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites: Signals and systems, Digital signal Processing, Digital Image Processing

Course Objectives:

- To understand the fundamental concepts of digital signal processing and Image processing.
- To explore DFT for 1-D and 2-D signal and FFT for 1-D signal
- To apply processing techniques on 1-D and Image signals.
- To apply digital image processing techniques for edge detection.

Course Outcomes:

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

1.	Compute signal spectrum of discrete system using DFT/FFT algorithms in MATLAB
2.	Design the digital filter in MATLAB environments
3.	Perform Basic operations on an image to improve the appearance and quality of images in Spatial and frequency domain filtering.
4.	Apply erosion and dilation morphological operators to remove irrelevant details.
5.	Detect the edge for given image using Sobel and Prewitt operator.
6.	Compute and analyze signal spectrum of discrete system using DFT/FFT algorithms in MATLAB

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1			2	2			1	1	1			2	1	
CO2	1		2	2	2			1	1	1			2		
CO3	1		1	2	2			1	1	1			2		
CO4	1			2	2			1	1	1			2		
CO5	1			2	2			1	1	1			2		
CO6	1			2	2			1	1	1			2	1	

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

CYCLE IDigital Signal Processing based Experiments

1. Write a MATLAB program to find

(i) Circular convolution of the given two sequences

(ii) Linear convolution using circular convolution.

2. Write a MATLAB program to find the spectrum of the given sequence using FFT.
3. Write a MATLAB program to design Butterworth (i) low pass filter (ii) band pass filter for the given specifications.
4. Write a MATLAB program to design Chebyshev type-I and II (i) high pass filter (ii) bandreject filter for the given specifications.
5. Write a MATLAB program to convert given analog filter into digital filter using (i) Impulse invariant method (ii) Bilinear transformation

6. Write a MATLAB program to design a FIR low pass filter using various windows techniques.
7. Write a MATLAB program to plot the frequency response of low pass filter using Kaiser window for different values of β

Code composer studio

8. Linear and circular convolution using CC Studio
9. IIR Filter design using TMS320C6713 DSP Processor
10. FIR Filter design using TMS320C6713 DSP Processor

CYCLE IIDigital Image Processing based Experiments

1. Write a Program in MATLAB to

a. Obtain Negative image b. Obtain Flip image c. Threshold operation (Thresholding)
d. Contrast stretching (e) Zooming

2. Write a program to
   (a) compute the histogram of an input image
   (b) To improve the appearance using histogram equalization technique.

3. Write a program for following geometric transformation on image

(a) Translation (b) Scaling (c) Rotation (d) Shrinking (e) Zooming

4. Write a MATLAB program to add noise in the image and apply image restoration technique using Wiener filter and median filter
5. Write a program to perform smoothing and sharpening operation of an image using spatial filtering
6. Write programs for image

(a) Apply FFT and IFFT on given image (b) Perform low pass and high pass filtering in frequency domain

7. Write a program in MATLAB for edge detection using different edge detection mask
8. Write programs to implement following morphological operations on images

(a)Erosion (b) Dilation (c)Closing (d)Opening

VIRTUAL INSTRUMENTATION LAB

ECE 416(c) **Credits:2**

Instruction: 3 Practical‟s /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites: Nil

Course Objectives:

- To introduce the concept of virtual instrumentation and to develop basic VI programs using loops, case structures etc. include its applications in image, signal processing and motion control.

Course Outcomes:

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

1.	Develop software programs called virtual instruments that apply user interface, program control, data structures, file input output, hardware interfacing, data analysis and signal processing
2.	Experiment with, analyze and document prototype measurement systems using a computer, plug in DAQ interfaces and bench level instruments.
3.	Build an engineering application in lab view, install and configure data acquisition hardware.
4.	Design DAQ using LABVIEW modules.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2							1			3	2	1	1
CO2	2			1		3		1	2	1		3	2	1	1
CO3	2	2	2		1		2				3	3	2	1	1
CO4	2	1	1			3				1	2	3	2	1	1

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

List of Experiments

Experiment 1:
Introduction To Labview
Installing labview software and other toolkits

Experiment 2:
1. Basic arithmetic operations
2. Boolean operations
3. Sum of „n‟ numbers using „for‟ loop

Experiment 3:
4. Factorial Of A Give Number Using For Loop
5. Sum Of „N‟ Natural Numbers Using While Loop
6. Factorial Of A Give Number Using While Loop

Experiment 4:
7. Sorting even numbers using while loop in an array
8. Array maximum and minimum

Experiment 5:
9. Bundle And Unbundle Cluster
10. Flat And Stacked Sequence
11. Application Using Formula Node

Experiment 6:
12. Median Filter
13. Discrete Cosine Transform

Experiment 7:
14. Convolution Of Two Signals
15. Filter Design Using Windowing Technique

Experiment 8:
16.File Transfer Using Sockets

Experiment 9:
17. Acquiring And Processing Speech Signal
18. Acquiring And Processing Image Signal

Experiment 10:
19. Talking Tom Application
20. Developing A Scientific Calculator

Experiment 11:
21.Digital Modulation Like Psk, Qam
22.Estimation, Ber And Eye Diagram

Experiment 12:
23.Design Of Various Filters Like Wave Shaping, Matched, Equalizer

ANTENNA DESIGN LAB

ECE 416(d) **Credits:2**

Instruction: 3 Practical‟s /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites:

Nil

Course Objectives:

- To design Wire antennas, Microstrip antennas and Microstrip based filters using HFSS
- To extract the various parameters that indicate the performance metrics of an antenna.

Course

Outcomes:

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

1.	Design an Extract the parameters of knowledge in getting usage of simulation software
2.	Design the antenna with given specification using the simulation tools.
3.	Extract the various parameters that indicate the performance of the antenna
4.	Interpret the extracted results and analyze them and prepare a formal laboratory report.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	1	-	-	-	-	2	-	-		1	2	2
CO2	2	2	1	3	-	-	-	-	2	-	-	2	2	2	2
CO3	2	2	2	1	-	-	-	-	2	3	-	1	1	1	1
CO4	2	3	3	3	-	-	-	-	2		-	3	1	2	2

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

List of Experiments

1. Design an edge fed microstrip patch antenna & study its S-parameters
2. Design an inset fed microstrip patch antenna & study its S-parameters
3. Design an microstrip line fed slot coupled patch antenna & study its S- Parameters
4. Design a probe fed microstrip patch antenna & study its S- Parameters
5. Design a coplanar waveguide fed patch antenna & study its S- Parameters
6. Design an edge fed microstrip patch antenna & study its 2-D & 3-D radiation Patterns
7. Design an inset fed microstrip patch antenna & study its 2-D & 3-D radiation Patterns
8. Design an microstrip line fed slot coupled patch antenna & study its 2-D & 3-D radiation Patterns
9. Design a probe fed microstrip patch antenna & study its 2-D & 3-D radiation Patterns
10. Design a coplanar waveguide fed patch antenna & study its 2-D & 3-D radiation Patterns

DIGITAL COMMUNICATIONS LABORATORY

ECE 417
Credits:2
Instruction: 3 Practicals /Week Sessional Marks:50
End Exam: 3 Hours End Exam Marks:50

Prerequisites: Communication Systems Engineering**,** Digital Communications, Signals andSystems.

Course objectives

The course objectives are to enable the students to:

- Analyze PCM, DPCM and Delta modulation /demodulation schemes.
- Implement different digital modulation schemes like FSK, PSK and DPSK.
- Understand different source/channel coding techniques.
- Simulate different blocks of a digital communication system.

Course Outcomes:

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

1.	Evaluate the performance of PCM, DPCM and Delta modulation schemes
2.	Implement different digital modulation schemes like FSK, PSK, and DPSK
3.	Analyze source/channel encoding & decoding methods.
4.	Simulate Pulse Digital Modulation & demodulation using MATLAB
5.	Simulate digital communication techniques like ASK, FSK & PSK.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2		2	2				1	1	1				3	
CO2	3		3	2				1	1	1				3	
CO3	2		3	3				1	1	1				3	
CO4	2		2	2	3			1	1	1				3	
CO5	2		2	2	3			1	1	1				3	

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

CYCLE I Experiments Based on Hardware

1. Generation and Detection of Pulse Code Modulation for both A.C and D.C signals
2. Generation and Detection of Differential Pulse Code Modulation
3. Generation and Detection of Delta Modulation
4. Generation and Detection of PSK.
5. Generation and Detection of FSK.
6. Generation and Detection of DPSK.
7. Generation and Detection of QPSK.
8. Source Encoder and Decoder
9. Linear Block code-Encoder and Decoder
10. Convolution code-Encoder and Decoder

CYCLE II Experiments Based on Software

1. Simulation of Pulse Code Modulation
2. Simulation of Differential Pulse Code Modulation
3. Simulation of Amplitude Shift Keying
4. Simulation of Phase Shift keying
5. Companding
6. Simulation of Time Division Multiplexing

Note:A student has to perform minimum of 10 experiments.

INDUSTRIAL TRAINING

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE418	Industrial Training Seminar	IT	-	2	2	4	100	-	4

Prerequisites: Nil

Course Objectives:

- To expose students to the 'real' working environment and get acquainted with the organization structure, business operations and administrative functions.
- To promote cooperation and to develop synergetic collaboration between industry and the university in promoting a knowledgeable society.
- To set the stage for future recruitment by potential employers.

Course Outcomes:

After successful completion of industrial training, students will be able to

1.	Gain hands-on experience in their related field with good technical knowledge and exposure on usage of modern tools.
2.	Apply technical skills, tools and techniques to achieve project objectives and understand the impact of engineering solutions on people and environment during the development of sustainable mini/major projects.
3.	Acquire exposure on ethical norms of engineering practice and cultivate leadership qualities and demonstrate responsibility to perform or execute the given task as an individual/ in a team
4.	Communicate effectively through report writing, technical presentation of the solutions to problems (Oral, Visual written)
5.	Recognize the need for lifelong learning and enhance their employability skills with good technical knowledge and exposure on usage of modern tools.

CO-PO –PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	3								2	2	2
CO2						3	3				3				
CO3								3	3						
CO4										3					
CO5												3			
	3	2	2	2	3	3	3	3	3	3	3	3	2	2	2

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

PROJECT PHASE – I

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE419	Project Phase – I	PW	-	-	8	8	100	-	4

Prerequisites: Nil

Course Objectives:

- To inculcate the how to undergo literature survey and interpret data collected.
- To understand how to make project plan
- To understand the identification and selection of appropriate techniques, resources and IT tools required to carry out a project
- To demonstrate the ability to work as an individual and in a team effectively to achieve the task.

Course Outcomes:

After successful completion of Project Phase-1 students will be able to

CO1	Identify the mathematical, engineering and other relevant knowledge that applies to a problem
CO2	Demonstrate the ability to identify and characterize an engineering problem through review research literature describing the causes of the problem and its effects using first principles of mathematics, natural sciences, and engineering sciences
CO3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
CO4	Demonstrate collaborative skills and independent learning through working in a team to complete a task.
CO5	Scheduling an engineering project and identifying the resources required to complete an engineering activity.

CO-PO –PSO Mapping

COURSE OUTCOMES		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Identify the mathematical, engineering and other relevant knowledge that applies to a problem	3												3	3	3
CO2	Demonstrate the ability to identify and characterize an engineering problem through review research literature describing the causes of the problem and its effects using first principles of mathematics, natural sciences, and engineering sciences		3		3											
CO3	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.				3	3								3	3	3
CO4	Demonstrate collaborative skills and independent learning through									3	3		3			

	working in a team to complete a task.															
CO5	Scheduling an engineering project and identifying the resources required to complete an engineering activity.											3				

CELLULAR AND MOBILE COMMUNICATIONS

ECE 421 **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Communication Systems Engineering**,** Digital Communications

Course objectives:

- To understand the cellular radio concepts such as frequency reuse, Cell splitting and affect of interference on the capacity of cellular system.
- To interpret small scale, large scale and multipath propagation models used in mobile environment.
- Develop an ability to analyze Frequency management and channel assignment strategies, Handoff and dropped calls.
- To describe various multiple access techniques, forward and reverse channels and capacity of cellular system.
- To identify the concept behind integration of mobile satellite and terrestrial mobile systems.

Course Outcomes:

At the end of the course, students will be able to	
1.	Evaluate the performance of a cellular system in terms of Frequency reuse, interference and Cell splitting.
2.	Analyze the Mobile radio propagation, fading, diversity concepts and the channel modeling.
3.	Evaluate the concepts of Handoff, dropped calls, Frequency management and channel assignment strategies.
4.	Apply cellular theory and analyze various Multiple access techniques in wireless communications.
5.	Interpret the technical challenges in implementation of receiver circuitry with the integration of mobile satellites.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1											2	
CO2	2	2	1											2	
CO3	3	1												2	
CO4	2	2												2	
CO5	2	1				1								1	

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction to Cellular Systems: Basic Cellular Systems, Uniqueness of mobile radio environment, Concept of Frequency reuse Channels, Cochannel interference Reduction factor, Desired C/I from a normal case in an Omnidirectional Antenna system, Non Co-channel interference, Cell splitting.

UNIT II 10 Periods

Mobile Radio Propagation: Large scale path loss - Reflection, Diffraction, Scattering, Outdoor and Indoor Propagation models, **Mobile Radio Propagation: small scale fadingand multi path** - small scale Multi path measurements, parameters of mobile multi path channels, Types of small-scale fading.

UNIT III 10 Periods

Frequency Management and Channel Assignment: Frequency management, Fixed Channels assignment, Non Fixed Channel assignment, Traffic and Channel Assignment. **Hand Off, Dropped Calls:** Why Hand-Off, Types of Hand-Off and their characteristics, dropped call rates and their evaluation.

UNIT IV 10 Periods

Multiple access techniques for wireless communications: FDMA, TDMA, Spread spectrum techniques, SDMA, Packet Radio, CSMA , Capacity of cellular CDMA with multiple cells and capacity of SDMA, Details of forward and reverse CDMA channels

UNIT V 10 Periods

Personal access communication systems, personal Mobile satellite communications, Integrating GEO, LEO, MEO satellite and terrestrial mobile systems, Rake receiver and Advanced Rake receiver.

***Note-** Additional topics that can be introduced during the course but are out of the prescribed syllabus – **Performance of Fading channels**

TEXT BOOKS:

1. William C.Y.Lee, Wireless & Cellular Telecommunications, Third Edition,McGraw Hill, International Edition. **[UNIT- I ,II,III]**
2. Theodore S.Rappaport, Wireless communications Principles and Practice, Second Editions, Pearson Publications. **[UNIT- IV ,V]**

REFERENCE BOOKS:

1. GottapuSasibhushanaRao, Mobile Cellular Communication, PEARSON International, 2012.
2. Wayne Tomasi, Electronic Communication system, Pearson.

PHASED ARRAY SYSTEMS

ECE 422(a) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Antenna and Wave Propagation

Course Objectives:

- To have an understanding of antenna element & use number of such elements to form a phased array and effectively use for the better performance. Understand and Use of different feeds for the phased arrays for different applications. It also introduces the students with respect to measurements on characteristics of the array.

Course Outcomes:

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

1.	Apply the knowledge the engineering and science in understanding and differentiating various system requirements with phased arrays for radar and communication system.
2.	Analyze linear/planar array antennas with required side lobes, beam width, bandwidth etc., and determine their directivity & study various scanning techniques.
3.	Identify, formulate and analyze different antennas to form an array for a given application
4.	Formulate the array patterns using various synthesis techniques
5.	Apply different feeding mechanisms for resonant and travelling wave arrays & measure different parameters of the array

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2		-	-	-	-	-	-	-	-	-		2	
CO2	3	3		-	-	-	-	-	-	-	-	-		3	
CO3	3	3		-	-	-	-	-	-	-	-	-		3	
CO4	3	3		-	-	-	-	-	-	-	-	-		1	
CO5	2	2		-	-	-	-	-	-	-	-	-		1	

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Phased Arrays in Radar and Communication Systems: System requirements for radar and communication antennas - Directive properties of Arrays, Array noise characterization, receiving antenna in polarized plane wave field, system considerations, Monopole beam splitting, Array characterization for radar and communication systems - Fundamental results from array theory, Array size determination, Time-delay compensation.

UNIT II 10 Periods

Array Characteristics : Characteristics of linear and planer arrays, Scanning to End-fire, **Scanning Technique:** Introduction Conventional Scanning, Mechanical versus Electronic scanning, Techniques of Electronic scanning, Frequency, Phase and Time Delay scanning principle, Hybrid scanning techniques, Thinned Arrays

UNIT III 10 Periods

Elements for phased array : Introduction , array elements, polarization characteristics of infinitesimal elements in free space; Electric current antenna elements - dipole and the monopole; Aperture antenna elements – slot elements, waveguide radiators, horn elements, microstrip patch element

UNIT IV 10 Periods

Phased Array Systems: Beam steering in Phased arrays; Phase Shifters and fundamentals of phase shifters. Parameters effecting the performance of Radar System including parameter management/ error analysis; operational scenario; Multifunctional operations; Transmit - Receive Modules; System Design Methodology, Integration and Testing and Evaluation of Radar Systems ; Introduction on existing PARs . Advances in Phased arrays.

UNIT V 10 Periods

Array Feeds & Measurements: Introduction**,** Series feeds: Resonant Arrays- Impedance and bandwidth, Resonant slot array Travelling Wave Arrays- Frequency Squint and Single Beam condition, Calculation of element conductance, TW slot array Frequency scanning, Phase scanning; Shunt feeds: Corporate feeds, distributed feeds, Introduction - measurement of Low sidelobe patterns & scanning phenomena.

TEXT BOOKS:

1. Robert J. Mailloux, Phased Array Antenna Handbook, Third Edition, Artech House, 2017 **[UNIT- I ,II &III]**
2. R.C.Hansen, Phased Array Antennas, Second edition, John Wiley & Sons Publications 2009 **[UNIT - IV]**

REFERENCE BOOKS:

1. Peter J. Kahrilas, Electronics Scanning Radar Systems Desing Handbook, Artech House, 1976.
2. A. A. Olinar, G. H. Knittel, Phased Array Radar, Artech House, 1972
3. Skolnik, M.I., Radar Handbook, 3rd edn., The McGraw-Hill Companies, 2008

BIOMEDICAL INSTRUMENTATION

ECE 422(b) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To introduce an fundamentals of transducers as applicable to physiology
- To explore the human body parameter measurements setups
- To make the students understand the basic concepts of forensic techniques.
- To give basic ideas about how multimedia evidences are useful in crime investigation.

Course Outcomes:

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

1.	Apply various methods of acquiring bio signals.
2.	Analyze different biomedical electrodes and sensors used for clinical observation.
3.	Analyze ECG and EEG signal with characteristic feature points.
4.	Measure heart rate, blood pressure and respiration rate. And also understand various sources of blood flow meters.
5.	Apply the knowledge of bio-telemetry & instrumentation in Clinical Laboratory.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1		2								1	2		
CO2	2	1		2								1	2		
CO3	2	2		2								1	2		
CO4	2	1		2								1	2		
CO5	1			1								1	2		

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I **1**0 Periods

Introduction to Biomedical Instrumentation: Sources of Biomedical Signals, Basic Medical Instrumentation System, Intelligent Medical Instrumentation Systems, PC Based Medical Instrumentation Systems, General Constraints & Regulations of Medical Devices

UNIT-II 10 Periods

Electrodes, Sensors, and Transducers: Transduction – Electrodes for biophysical sensing – types of electrodes: surface, needle, micro – inductive, capacitive and temperature transducers

UNIT-III 10 Periods

Measurement of Biological, Physiological parameters: Measurement of blood pressure, blood volume, respiration rate, temperature, ECG, EEG, EMG and PCG, Safety measures implemented in Biomedical Instrumentation

UNIT-IV

Patient Monitoring Systems and ICU assisting devices: Intensive cardiac care units and Central monitoring systems, Patient monitoring through biotelemetry.
Pacemakers, Defibrillators, Ventilators and Respirators

UNIT-V

Bio telemetry and Instrumentation for the clinical laboratory: Introduction to biotelemetry, physiological parameters adaptable to biotelemetry, the components of biotelemetry system, implantable units, applications of telemetry in patient care.

TEXT BOOKS:

1. Leslie Cromwell, Fred J Weibell and Erich A Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd Edition, Pearson, 2003**(UNIT-I,II,&III)**
2. Khandpur R.S, "Hand Book of Biomedical Instrumentation", Tata McGraw Hill publication, New Delhi 2nd edition 2003.(**UNITS - IV &V)**

REFERENCE BOOKS:

1. Joseph J. Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", 4th Edition, Pearson Education, 2001.
2. John Enderle, Susan Blanchard, Joseph Bronzino, "Introduction To Biomedical Engineering", 2nd Edition.
3. Geddes L.A., and L.E. Baker, Principles of applied Biomedical Instrumentation, 3rd Ed., Wiley, 1989

OPTICAL COMMUNICATIONS

ECE 422(c) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Basic of Optics, Electromagnetic Theory, Communication systems, and Computernetworks

Course Objectives:

- To describe the propagation of light signal in optical fibers and space
- To illustrate the operation of various components in optical fiber communication system
- To design of optical link
- To understand the concept of optical network

Course Outcomes:

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

1.	Illustrate the structure and fabrication methods of Optical fibers
2.	Analyze the channel impairments: losses and dispersion
3.	Illustrate the operation and working of Optical sources (LED and LASER) and detectors (PIN and Avalanche Photo diode).
4.	Apply design considerations to analog and digital fiber optic systems
5.	Analyze the components of fiber optic networks: Couplers, multiplexers, switches and filters.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2												2	
CO2	2	2												2	
CO3	2	2												2	
CO4	2	2												2	
CO5	1	1												2	

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction To Optical Communications:Unguided optical communications – Li-fi - Evolution of fiber optic communications - Basic elements of an optical fiber communication link – Structure of optical fiber waveguide – Total internal reflection - Step-index and graded index fibers - Fiber materials – fiber fabrication – optical fiber cable

UNIT II 10 Periods

Signal Degradation In Optical Fibers: Modal analysis - single mode and multi mode fibers - Signal attenuation in optical fibers - Dispersion effects in optical fibers - Dispersion Shifted, flattening and Compensating Fibers

UNIT III 10 Periods

Optical Sources, Detectors and Amplifiers: Semiconductor Laser diode - LED - Source to Fiber Power launching and coupling - PIN and Avalanche photodiodes - Noise in detection process – Erbium Doped Fiber Amplifiers

UNIT IV 9 Periods

Design Considerations Of Fiber Optic Systems: Optical Tx/Rx Circuits - Power Budget and Rise

time Budget of point-to-point digital links

UNIT V 12 Periods

Overview Of Optical Networks: Coupler – Multiplexer – Fiber grating filters - TDM, Broadband and dense WDM in fiber optic communications –- SONET / SDH - introduction to FTTH – Optical switching - Broadcast and select WDM Networks –Wavelength Routed Networks

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communications, 5th Ed., Tata McGraw Hill, 2017 **(UNITS I –V)**
2. DjafarMynbaev and Lowell Scheiner, Fiber-Optic Communications Technology, Pearson education, 2001**(UNITS I, II, III &V)**

REFERENCES:

1. John Senior, Optical Fiber Communications – Principles and practice, 3rd Ed. Pearson, 2008
2. John Powers, An introduction to fiber optic systems, 2nd Ed., McGraw Hill, 1999
3. Rajiv Ramaswami, Kumar Sivarajan and Galen Sasaki, Optical Networks: A Practical Perspective, Morgan Kaufmann, 3rd ed., 2009

EMBEDDED AND REAL – TIME SYSTEMS

ECE 422(d) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Digital Electronics, Computer Architecture & Organization, Microprocessors,Micro-controllers & Embedded Systems

Course Objectives:

- To understand the concept of embedded system, microcontroller, different components of microcontroller and their interactions.
- To get familiarized with programming environment to develop embedded solutions.
- To program ARM microcontroller to perform various tasks.
- To understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.

Course Outcomes:

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

1.	Acquire knowledge of embedded systems architecture with respect to both hardware and software
2.	Acquire knowledge of real time systems
3.	Apply with the concepts of Embedded/Real-Time operating Systems
4.	Acquire working knowledge of various operating Systems
5.	Illustrate the functionality of embedded system

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3		-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3		-	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3		-	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3		-	-	-	-	-	-	-	-	-	-	-	-	2

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Architectures of Embedded Systems: Classification of Embedded Systems, Skills required for an Embedded System Designer, Hardware architecture: Processor, RTC, Communication buses, power supply, sensors, actuators, Watchdog timer, Embedded S/W Architectures: Round-Robin, Round-Robin with Interrupts, Function-Queue Scheduling, Real-Time Operating System; Architecture of an application.

UNIT II 08 Periods

Real Time Systems: Introduction: A car-and – driver example, Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real time Systems, Estimating program run-Times.

UNIT III 12 Periods

Embedded/Real-Time Operating System Concepts: Architecture of Kernel, Tasks and Tasks scheduler. ISR, Semaphores, Mutex, Mailboxes, Message Queues, Event Registers, Pipes, Signals, Timers, Memory management, Priority inversion problem

UNIT IV 10 Periods

Overview of Embedded/Real-Time Operating Systems: Application Software, Communication Software, Off-the-Shelf operating Systems, Embedded Operating Systems, Real-Time Operating Systems, Hand-held Operating Systems

Operating system Concepts:

Architecture, Different subsystems, The Scheduler, Objects, Services

UNIT V 08 Periods

Basics of Embedded System development: Co-design issues, Languages, tools, design issues and embedded system models for design.

TEXT BOOKS:

1. Dr. K.V.K.K. Prasad, Embedded/Real-Time Systems: Concepts, Design & Programming, New edition 2011, Dreamtech Press**(UNIT-I,III &IV)**
2. C.M. Krishna, Kang G. Shin, Real-Time Systems, Indian Edition 1997, Tata McGraw Hill**(UNIT-II &V)**

REFERENCE BOOKS:

1. Qing Li, Caroline Yao, Real-Time Concepts for Embedded Systems, First edition 2014, Elsevier, CMP Books.

SATELLITE COMMUNICATIONS & GPS

ECE 423(a) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Communication Systems Engineering**,** Digital Communications

Course Objectives:

- To get in depth knowledge of communication through satellite
- To understand the design criterion
- To introduce students to the principle of GPS.
- To familiarize students with GPS signal structure.

Course Outcomes:

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

1.	Describe satellite and earth station subsystems with orbital aspects.
2.	Analyze C/N ratio for satellite link budgets considering propagation and atmospheric losses.
3.	Classify and analyze multiple access techniques used in satellite communication.
4.	Illustrate the working principle of GPS and determine GPS receiver position using satellites in 2D & 3D.
5.	Illustrate GPS system segments, GPS signals & signal structures using PRN codes.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2												2	
CO2	3	2												2	
CO3	2	1												2	
CO4	2	1												1	
CO5	2	2												2	

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction : Types of satellites- Satellite orbit- satellite constellation- orbital mechanics- equation of orbit-orbital elements- look angle determination- limits of visibility- eclipse- sub satellite point- sun transit outage- space craft technology structural, primary power, attitude and orbit control, thermal, propulsion, telemetry, tracking and command, communication subsystems- launching procedures and launch vehicles

UNIT II 10 Periods

Propagation Impairments And Space Link: Introduction, atmospheric loss, ionospheric effects, rain attenuation, other impairments.

Space link: Introduction, EIRP, transmission losses, link power budget, system noise, CNR, uplink, down link, effects of rain, combined CNR

UNIT III 10 Periods

Multiple Access: Frequency division multiple access (FDMA) Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA),Spread spectrum transmission and reception.

UNIT IV 10 Periods

Introduction To Global Navigation Satellite Systems(GNSS): The History of GPS, The Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites. GPS working principle, Trilateration, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or XY Plane, Determining the receiver position in 3D or X-Y-Z Plane

UNIT V 10 Periods

GPS Satellite Constellation And Signals: GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code , P code Navigation data, Signal structure of GPS.

***Note-** Additional topics that can be introduced during the course but are out of the prescribed syllabus –**The working of a satellite phone, Introduction to IRNSS**

TEXT BOOKS:

1. T. Pratt and C.W. Boastian, "Satellite Communication", 2 nd edition, John Wiley & Sons, 2002**.(UNIT-I,II,III)**
2. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010**(UNIT-IV,V)**

REFERENCE BOOKS:

2. D. Roddy, "Satellite Communications", Prentice Hall, 4 th edition, copyright, 2008.
3. K.N. Raja Rao, "Satellite Communication: Concept and Application", 2nd edition, PHI, 2013

VLSI SIGNAL PROCESSING

ECE 423(b) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: VLSI Design, Digital IC Design and Digital signal Processing

Course Objectives:

- Interpret the pipelining and parallel processing techniques to the VLSI systems
- Analyze the retiming, unfolding & folding concepts for register minimization
- Infer the systolic architectures
- Design and analyze FIR filters circuits for signal processing
- Apply the fast convolution algorithms to signal processing applications

Course Outcomes:

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

1.	Represent the DSP algorithms and transforms as systems with block, signal flow and data Flow diagrams.
2.	Design pipeline and parallel processed FIR filters.
3.	Perform retiming and minimize the registers and solve the systems of inequalities.
4.	Design systolic architecture using canonical mapping and generalized mapping
5.	Design and analyze parallel and pipeline IIR

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										2	2	1
CO2	2	2	1										2	2	1
CO3	1	2	3										2	2	1
CO4	1	1	2										2	2	1
CO5	1	1	2										2	2	1

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction to the VLSI Signal Processing : Typical Signal Processing Algorithms, Overview of VLSI Architectures, Representations of DSP Algorithms.

Pipelining and parallel processing: Introduction, Data Flow Graph Representation, Loop bound and Iteration Bound, Algorithms for computing Iteration bound, Pipelining of FIR filters, Parallel Processing

UNIT II 10 Periods

Retiming: Definitions and Properties, Solving systems of inequalities, Retiming techniques.

Unfolding and Folding: Unfolding Algorithm, Properties of unfolding, Critical Path, Unfolding and Retiming, Folding Transformation, Register Minimization techniques

UNIT III 10 Periods

Systolic Architecture Design
Matrix Operations and 2D Systolic Array Design, Parallel Algorithm Expressions, Canonical Mapping Methodology.

Arithmetic components
Parallel bit circuits: Carry-Look ahead addition, Prefix Computations, Carry-Save Addition, Multiplication.

UNIT IV 10 Periods
Fast Convolution: Introduction, Cook-Toom algorithm, Winogard algorithm, Iterated Convolution and Cyclic convolution.
UNIT V 10 Periods
Programmable Digital Signal Processors
Important Features, DSP Processors for Mobile and Wireless Communications, Processors for Multidimensional Signal Processing.
TEXT BOOKS:
1. K. K. Parhi, "VLSI Digital Signal Processing Systems, Design and Implementation", John Wiley, 1999**(UNIT-I,II,III,IV &V)**
REFERENCE BOOKS:
1. S.Y.Kung, "VLSI Array Processors", Prentice-Hall, 1988

WIRELESS SENSOR NETWORKS

ECE 423(c) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Telecommunication Switching & Networks, Computer Network Engineering, Communication Systems Engineering.

Course Objectives:

- To study the concepts of wireless sensor networks.
- To study the architectures of various sensor networks
- To understand the functionality of MAC protocols
- To understand the knowledge of WSN and its applications

Course Outcomes:

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

1.	Apply the concept of wireless sensor networks.
2.	Analyze various sensor network scenarios and architectures
3.	Illustrate the functionality of various classes of MAC protocols
4.	Illustrate the method of allocation of addresses and management of names in WSNs
5.	Acquire knowledge of WSN and its applications.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1											2		
CO2	2	2											2	2	
CO3	2	2											2	2	
CO4	2	1											1		
CO5	1	1											1		

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 12 Periods

Introduction to Wireless Sensor Networks: Ambient Intelligence, Types of Applications, Challenges for WSNs, Differences between mobile ad hoc networks and wireless sensor networks, Enabling Technologies for Wireless Sensor Networks.

Single-Node Architecture: Hardware Components, Operating Systems and Execution Environments: Embedded operating systems, Programming paradigms and application programming interfaces

UNIT II 8 Periods

Network Architecture: Sensor Network Scenarios, Optimization goals and figures of merit, Design principles for WSNs - Distributed organization, In-network processing, Adaptive fidelity and accuracy.

Physical Layer and Transceiver Design Considerations - Energy usage profile, Choice of modulation scheme

UNIT III 12 Periods

MAC Protocols for Wireless Sensor Networks: Fundamentals of (wireless) MAC protocols: Requirements and design constraints for wireless MAC protocols, Important classes of MAC protocols, MAC protocols for wireless sensor networks, Low duty cycle protocols – STEM, Contention-based protocols: CSMA protocols, Schedule-based protocols: LEACH, Simulation study of protocols

UNIT IV 8 Periods

Naming and addressing: Fundamentals, Use of addresses and names in sensor networks, Address management tasks, Uniqueness of addresses, Address allocation and assignment, Addressing overhead, Address and name management in wireless sensor networks.

UNIT V 10 Periods

Localization and positioning: Properties of localization and positioning procedures, Possible approaches, Proximity, Trilateration and triangulation, Mathematical basics for the lateration problem, Single-hop localization: Active Badge, Active office, RADAR, Cricket
APPLICATIONS of WSN: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications.

***Note-** Additional topics that can be introduced during the course but are out of the prescribed syllabus – **Case study on TinyOS**

TEXT BOOKS:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005 **[UNIT- I-V]**
2. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007. **[UNIT- V]**

REFERENCE BOOKS:

1. C. S. Raghavendra, Krishna M. Sivalingam, Wireless Sensor Networks, Springer, 2004.
2. S Anandamurugan, Wireless Sensor Networks, Lakshmi Publications

COGNITIVE RADIO NETWORKS

ECE 423(d) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Electromagnetic Wave Propagation and Characteristics, Communication System Engineering, Digital Signal Processing.

Course Objectives:

- To introduce the mathematical modeling and design issues of OFDM and MIMO
- To understand Software Defined Radio architecture and its parameters
- To learn mathematical model for cognitive radio networks
- To understand the concepts of spectrum sensing network.
- To understand Regulatory Issues and International Standards

Course Outcomes:

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

1.	Illustrate the mathematical modeling and design issues of OFDM and MIMO
2.	Evaluation of Software Defined Radio architecture and its parameters
3.	Develop mathematical model for cognitive radio networks
4.	Analyze spectrum sensing network by using OFDMA and spectrum management by Heterogeneous Wireless Networks
5.	Interpret Regulatory Issues and International Standards

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2												2		
CO2	2												1	2	
CO3	2													2	
CO4	2												2	2	
CO5	2														

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

INTRODUCTION TO WIRELESS COMMUNICATIONS

Software Defined Radio Architecture, Digital Signal Processor and SDR Baseband Architecture, Reconfigurable Wireless Communication Systems: Unified Communication Algorithm, Reconfigurable OFDM Implementation, Reconfigurable OFDM and CDMA, Digital Radio Processing: Conventional RF, Digital Radio Processing (DRP) Based System Architecture

UNIT II 10 Periods

SOFTWARE DEFINED RADIO AND ITS ARCHITECTURE

Software defined radio architectures, Hardware specifications, Digital aspects of Software defined radio, Current technology limitations, minimum power consumption, ADC performance trends

UNIT III 10 Periods

COGNITIVE RADIO NETWORKS Cognitive Radios and Dynamic Spectrum Access, Analytical Approach and Algorithms for Dynamic Spectrum Access, Fundamental Limits of Cognitive Radios, Mathematical Model and simulation of Networking Cognitive Radios.

UNIT IV 10 Periods

SPECTRUM SENSING Spectrum sensing to detect specific Primary System, Spectrum Sensing for Cognitive Radio OFDMA Systems and Cognitive Multi-Radio Networks

UNIT V 10 Periods

SPECTRUM MANAGEMENT Spectrum Management- Spectrum Sharing, Spectrum Pricing, Mobility Management to Heterogeneous Wireless Networks, Regulatory Issues and International Standards

TEXT BOOKS:

1. Kwang-Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & sons, 2009. **(UNIT- I,II,III,IV & V)**
2. EzioBiglieri, Robert Calderbank, "MIMO Wireless Communications" Cambridge University Press 2007

REFERENCE BOOKS:

1. Ahmed Khattab, Dmitri Perkins, MagdyBayoumi, "Cognitive Radio Networks : From Theory to Practice", Springer, 2013.
2. Walter Tuttlebee, "Software Defined Radio- Baseband Technology for 3G Handsets and Base stations", John Wiley @ Sons, 2004

MICROWAVE ENGINEERING LABORATORY

ECE 424 **Credits:2**

Instruction: 3 Practical‟s /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites:

Course Objectives:

- The main objective of this course is to make the students get the exposure to various microwave sources, microwave passive components and bench setup in this lab. Also, get the opportunity to measure various parameters related to components, and characterize microwave devices with the microwave bench setup.

Course Outcomes:

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

1.	Analyze the characteristics of microwave tubes.
2.	Measure the Frequency, Wavelength, VSWR and impedance of a microwave signal and load.
3.	Analyze the radiation pattern characteristics of horn antenna and yagi-uda antenna
4.	Determine the performance parameters of microwave junctions, directional coupler.
5.	Analyze a micro-strip patch antenna with given specification using simulation tools.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3		3				1	1	1				3	
CO2	1	3		3				1	1	1				3	
CO3	1	3		3				1	1	1				3	
CO4	1	3		3				1	1	1				3	
CO5	1	3		3	3	1		1	1	1				3	

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

List of Experiments

1. Study of microwave components
2. Vi characteristics of the gunn diode
3. Characteristics of reflex klystron
4. Measurement of the frequency and wavelength of a given signal
5. Measurement of the unknown load impedance of a given load
6. Measurement of the vswr of a given load
7. Determine the characteristics of a given directional coupler
8. Determine the attenuation characteristics of a given load
9. Determine the scattering parameters of e-plane tee junction
10. Determine the scattering parameters of h-plane tee junction
11. Determine the scattering parameters of magic tee junction
12. Determining the radiation pattern of the horn antenna
13. Study of antenna trainer systems
14. Determining the radiation pattern of a 3 element yagi- uda antenna with folded dipole
15. Determining the radiation pattern of a 5 element yagi- uda antenna with folded dipole

16. Determining the radiation pattern of a λ/2 phased array antenna

Note: A student has to perform minimum of 10 experiments.

PROJECT PHASE – II

Code	Subject name	Instruction periods per week					Max marks		Credits
		Cat	L	T	P	Total	Sessional	End marks	
ECE425	Project Phase - II & Dissertation	PW	-	-	16	16	100	100	8

Prerequisites: Nil

Course Objectives:

- To provide a comprehensive hands on experience to the students about the development of a complete project starting from analysis.
- To Identify and effectively communicate best methods within the framework of project management.
- To understand the project management, planning and use resources effectively for completion of project within time.

Course Outcomes:

After successful completion of Project Phase-II students will be able to

CO1	Apply the knowledge of mathematics, science, engineering fundamentals for analysis and synthesis of practical systems.
CO2	Conduct scientific and engineering experiments of their own, as well as analyze and interpret data.
CO3	Apply modern engineering techniques and simulation tools to solve engineering problems.
CO4	Carry out analysis of cost-effective, environmental friendly designs of engineering systems
CO5	Demonstrate skills in writing technical/project reports and oral presentation of the project work done to a panel of experts.

CO-PO –PSO Mapping

COURSE OUTCOMES		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Apply the knowledge of mathematics, science, engineering fundamentals for analysis and synthesis of practical systems.	3	3											3	3	3
CO2	Conduct scientific and engineering experiments of their own, as well as analyze and interpret data.				3				2				3			
CO3	Apply modern engineering techniques and simulation tools to solve engineering problems.					3								3	3	3
CO4	Carry out analysis of cost-effective, environmental friendly designs of engineering systems			3			2	2		3		3				
CO5	Demonstrate skills in writing technical/project reports and oral presentation of the project work done to a panel of experts.										3					