STUDENT HAND BOOK

A.Y:2023-24

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Vision of the Institute

To be recognized as a premier institution in offering the value based and futuristic quality technical education to meet the technological need of the society.

Mission of the the Institute

- To impart value quality technical education through innovative teaching and learning methods.
- To continuously produce employable technical graduates with advanced technical skills to meet the current and future technological need of the society.
- To prepare the graduate for high learning with emphasis on academic and industrial research.

Vision of the Department

To promote excellence in technical education and scientific research in electronics and communication engineering for the benefit of society.

Mission of the Department

- To impart excellent technical education with state of art facilities inculcating values and lifelong learning attitude.
- To develop core competence in our students imbibing professional ethics and team spirit.
- To encourage research benefiting society through higher learning

PEOs:

PEO 1: Establish themselves as successful professionals in their career and higher education in the field of Electronics & Communication Engineering and allied domains through rigorous quality education.

PEO 2: Develop Professionalism, Ethical values, Excellent Leadership qualities, Communication Skills and teamwork in their Professional front and adapt to current trends by engaging in lifelong learning

PEO 3: Apply the acquired knowledge & skills to develop novel technology and products for solving real life problems those are economically feasible and socially relevant

PEO 4: To prepare the graduates for developing administrative acumen, to adapt diversified and multidisciplinary platforms to compete globally.

Quality Policy

Our quality policy is to continuously strive for over-all development of the department and the students. Our policy is to provide best inputs to the students and to develop them to imbibe the spirit of professionalism, dedication & commitment.

Dress Code

- We encourage our students to be formally dressed on and off campus. This nurtures the feeling of equality and belongings among the students fraternity.
- All students are required to carry Photo Identity card at all the time while in the campus

POs:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with considerationfor sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complexengineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.(WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resourcesand modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.(WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, andas a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effectivereports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these toone's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for

i) independent and life-long learning ii) adaptability to new and emerging technologiesand iii) critical thinking in the broadest context of technological change. (WK8)

PSOs:

- Ability to apply concepts of Electronics & Communication Engineering to associated research areas of electronics, communication, signal processing, VLSI, Embedded systems
- Ability to design, analyze and simulate a variety of Electronics & Communication functional elements using hardware and software tools along with analytic skills

A Bird's Eye view about the Institution

CMR Engineering College, popularly known as CMREC is the brain child of the clairvoyant CH.Narasihma Reddy. CMR Engineering College is one of the best engineering Colleges for aspiring engineering students. It is one of the newly established Colleges by CMR Engineering Educational Society. CMR Engineering College was established in 2010 in 10 Acres and built up area of 4,785.78 Sq.m. with a single - minded aim to provide a perfect platform to students in the field of Engineering, Technology for their academic and overall personality development. The college has a very good academic activity which focuses for the campus placement.

The college is approved by the All India Council for Technical Education, New Delhi and is affiliated to JNT University Hyderabad. The CMREC is offering the three under graduate courses in ECE, CSE and MECH, and post graduate course in ECE and CSE.

Today, CMREC has grown in leaps and bounds and it is no wonder that CMREC has become cynosure of the eyes of many, hankering for the distinguished centre of technological learning.

Discipline, Character and Education are the three tenets for which CMREC stands, is certainly the haven where values blend seamlessly to churn out engineers for future.

- Collaborating with Institutions and Industries.
- Promoting research and development programme for the growth of economy.
- Disseminating technical knowledge in the region by continuing education programmes.
- Aiming at continual improvement of all round development of student

Department Profile

The Department of Electronics and Communication engineering of CMR Engineering College was established in the academic year 2010-11 with an annual intake of 120.The intake was increased to 180 from the academic year 2012-13 and later the intake was increased to 240 from the academic year 2013-14. In addition to this intake, the Department has 20% lateral entry students at II B.Tech level.
M.Tech programme was started with 24 intake in the specialization of Embedded Systems from the year 2013-14 and VLSI System Design from the year 2014-15
The B.Tech (ECE) program is duly approved by the AICTE and Government of Telangana and affiliated to Jawaharlal Nehru Technological University (JNTUH),Hyderabad. Three batches have graduated so far.
Department have 56 faculty and are members of professional bodies like ISTE,IEEE,IETE. Some of the students are the members of IETE student forum and IEEE student branch of the existing Department. A technical association (ECMRON) of ECE has been formed by the senior students of the department for the benefits of students to impart additional knowledge in the field of E&C Engineering apart from prescribed curriculum.
The Department has well equipped state of art laboratories to gain good knowledge and technical skills in the field of Electronics, Communication, Microwave, VLSI, Digital Signal Processing & Microprocessors & Microcontrollers. The Department periodically organizes seminars, symposia, workshops and guest lectures for the benefit of both the students and the faculty.

Established: 2010 **EAMCET Code:** CMRN

Academic Regulations, Course Structure andDetailed Syllabus under Autonomous Status

BACHELOR OF TECHNOLOGY (B.TECH.)

(CMREC – R-20 Regulations)

(Applicable for the batch admitted from 2020-2021)

PRELIMINARY DEFINITIONS AND NOMENCLATURES

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as Autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government of Telangana.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and supplementary semester.

Branch: Means specialization in a program like B.Tech. degree program in Electronics and communication Engineering, B.Tech degree program in Computer Science and Engineering, etc.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Backlog Course: A course is considered to be a backlog course, if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry etc., areconsidered to be foundational in nature.

Commission: Means University Grants Commission (UGC), New Delhi.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial/lab hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the processof study for a degree.

Dropping from Semester: Student who does not want to register for any semester can apply in writing in prescribed format before the commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicatedby alphabets.

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

Honors: An Honors degree typically refers to a higher level of academic achievement at anundergraduate level.

Institute: Means CMR Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Courses (MOOC): MOOC courses inculcate the habit of self-learning. MOOC courses would be additional choices in all the elective group courses.

Minor: Minor are coherent sequences of courses which may be taken in addition to thecourses required for the B.Tech. degree.

Pre-requisite: A specific course or subject, the knowledge of which is required to completebefore student register another course at the next grade level.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, UG degree program: Bachelor of Technology (B.Tech.) and PG degree program: Master of Technology (M.Tech.).

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a program.

Regulations: The regulations, common to all B.Tech. programs offered by Institute, are designated as – CMREC Regulations – R-20 and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. Odd semester commences usually in July and even semester in December of every year.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, is an affiliating University.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of odd or even semester. However, he / she can choose a substitute course in place of it by exercising the option within 5 working days from the dateof withdrawal.

FOREWORD

The autonomy is conferred to **CMR Engineering College (CMREC),** Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies including JNT University Hyderabad (JNTUH), Hyderabad and AICTE, New Delhi. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf. Thus, an autonomous institution is given the freedom to have its own **examination system** and **monitoring mechanism**, independent of the affiliating University but under its observance.

CMREC is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies such as Academic Council and Board of Studies (BOS) are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure, and syllabi under autonomous status.

The autonomous regulations, course structure, and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute in order to produce a quality engineering graduate to the society.

All the faculty, parents, and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and from the principal of the institute, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is requested for the successful implementation of the autonomous system in the larger interests of the institute and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS FOR B.TECH. REGULAR STUDENTS WITH EFFECT FROM ACADEMIC YEAR 2020 – 21 (CMREC R-20)

For pursuing four year under graduate Bachelor Degree Programme of study in Engineering (B.Tech.) offered by CMR Engineering College under Autonomous status is here in referred to as CMREC (An Autonomous Institution)

All the rules specified here in approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2020-21 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for CMR Engineering College (An Autonomous Institution).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, CMR Engineering College shall be the chairman Academic Council.

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

CMR Engineering College offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) with effectfrom the academic year 2020-21.

ADMISSION

Admission first year of four-year B. Tech. Degree Program of study in Engineering

Eligibility

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

1. Passed either Intermediate Public Examination (I.P.E.) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.
2. Secured a rank in the EAMCET examination conducted by the Telangana State Government or on the university or in the basis of any other order of merit approved by the university, for allotment of a seat by the Convener, EAMCET.

Admission Procedure

Admissions are made into the first year of four year B. Tech. Degree Program as per thestipulations of the TSCHE.

(a) Category A seats are filled by the Convener, TSEAMCET (70%).
(b) Category B seats are filled by the Management (30%).

Admission into the second year of four year B. Tech. degree Program in Engineering

Eligibility

A candidate seeking admission under lateral entry into the II year I Semester B. Tech. degree Program should have passed the qualifying exam (B.Sc. Mathematics or Diploma in concerned course) and based on the rank secured by the candidate in Engineering Common Entrance Test ECET (FDH) in accordance with the instructions received from the Convener, ECET and Government of Telangana allotted the seats.

Admission Procedure

Admissions are made into the II year of four year B. Tech. Degree Program through Convener, ECET (FDH) against the sanctioned strength in each Program of study as lateral entry students.

B. TECH. PROGRAMME STRUCTURE

Programs Offered

CMR Engineering College, an autonomous institution affiliated to JNTUH, offers the following B. Tech. Programs of study leading to the award of B. Tech. degree under theautonomous scheme.

1) B.Tech. Computer Science and Engineering
2) B.Tech. Computer Science and Engineering (Artificial Intelligence & Machine Learning)
3) B.Tech. Computer Science and Engineering (Data Science)
4) B.Tech. Computer Science and Engineering (Cyber Security)
5) B.Tech. Electronics and Communication Engineering
6) B.Tech. Information Technology
7) B.Tech. Mechanical Engineering

Duration of the Programs

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

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

listed below.

Semester Scheme

Each under graduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (90 instructional days) each, each semester having - Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).

Credit Courses

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

 One credit for one hour / week / semester for theory / lecture (L) courses or Tutorials.

 One credit for two hours / week / semester for laboratory / practical (P) courses. Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab are mandatory courses. These courses will not carry any credits.

Subject Course Classification

All subjects / courses offered for the under graduate program in E&T (B. Tech. degree programs) are broadly classified as follows.

S. No.	Broad Course Classification	Course Group /Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes mathematics, physics and chemistry subjects
2		ES - Engineering Sciences	Includes fundamental engineering subjects
3		HS – Humanities and Social sciences	Includes subjects related to humanities, social sciences and management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent Discipline / department / branch of Engineering
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective subjects related to the parent Discipline / department / branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline / department / branch of Engineering.
7		Project Work	B.Tech. project or UG project or UG major project or Project Stage I & II

8	Core Courses	Industrial training / Mini- project	Industrial training / Summer Internship / Industrial Oriented Mini-project /Mini-project

9		Seminar	Seminar / Colloquium based on core contents related to parent discipline / department / branch of Engineering.
10	Mandatory Courses (MC)	-	Mandatory courses (non-credit)

COURSE REGISTRATION

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

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

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

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

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

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

Open Elective Course: Students can choose One Open Elective Course (OEC-I) during VI Semester, one (OEC-II) during VII Semester and one (OEC-III) in VIII Semester from the list of Open Elective Courses given. However, Students cannot op for an Open Elective Courses offered by their own (parent) Department, if it is there in the already listed under any category of the Subjects offered by parent Department in any Semester.

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

SUBJECTS / COURSES TO BE OFFERED

A typical section (or class) strength for each semester shall be 60.

A subject / course may be offered to the students, **only if** a minimum of 20 students (1/3 of the section strength) opt for it. The maximum strength of a section is limited to 80 (60 + 1/3 of the section strength).

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

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

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

ATTENDANCE REQUIREMENTS

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

The attendance of Mandatory Non-Credit courses should be uploaded separately.

Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the students representation with supporting evidence**.**

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

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

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

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

ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. **6.0.**

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject / course, if student secures not less than 35% (25 marks out of 70 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing "**C"** grade or above in that subject / course**.**

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

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

Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first yearsecond semester	Regular course of study of first yearfirst semester.

2	First year second semester to secondyear first semester	(i) Regular course of study of firstyear second semester.
		(ii) Must have secured at least 19 credits out of 39 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Second year first semester to second year second semester	Regular course of study of second year first semester.
4	Second year second semester to thirdyear first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 47 credits out of 79 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to third year second semester	Regular course of study of third yearfirst semester.
6	Third year second semester to fourthyear first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 71 credits out of 119 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth yearfirst semester.

A student (i) shall register for all courses / subjects covering 160 credits as specified and listed in the course structure, (ii) fulfils all the attendance and academic requirements for

160 credits, (iii) earn all 160 credits by securing SGPA $\geq$ 5.0 (in each semester), and CGPA (at the end of each successive semester) $\geq$5.0, (iv) passes all **the mandatory courses**, to successfully complete the under graduate program. The performance of the student in these 160 credits shall be taken into account for the calculation of "the final CGPA" (**at the end of under graduate program**), and shall be indicated in the grade card of IV year II semester**.**

If a student registers for "extra subjects" (in the parent department or other departments / branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his / her department, the performances in those **"extra subjects"** (although evaluated and graded using the same procedure as that of the required 160 credits) will not be taken into account while calculating the SGPA and CGPA. For such **'extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6.0 and 7.1 – 7.4 above.

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

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

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

EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

The performance of a student in every subject / course (including practical and Project Stage – I & II) will be evaluated for 100 marks each, with 30 marks allotted for CIE (Continuous Internal Evaluation) and 70 marks for SEE (Semester End-Examination).

For all Theory Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE.

For Theory Subjects

Continuous Internal Evaluation (CIE)

1. During the Semester, there will be two mid-terms examinations for 30 marks each. Each mid-term examination consists of one subjective paper for 25 marks and assignment for 5 marks for each subject.
2. Question paper contains two Parts (Part-A and Part-B). The distribution of marks for PART- A and PART-B will be 10 marks & 15 marks respectively for UG programs.
3. Pattern of the question paper is as follows.

PART–A

- Consists of Five ***Short answer Questions*** each carrying two mark. The I-Mid-term examination shall be conducted for the 50% of the syllabus and II-Mid-term examination shall be conducted for remaining 50% of the syllabus.

PART-B

- Consists of Three questions (out of which students have to answer three questions) carrying five marks each. Each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question). The questions may consist of sub-questions also.
- The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.
- First Assignment should be submitted before the commencement of the first mid-term examinations, and the Second Assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified / given by the concerned subject teacher.
- The total marks secured by the student in each mid-term examination are evaluated for 30 marks, and the average of the two mid - term examinations shall be taken as the final marks secured by each student in Continuous Internal Evaluation.
- If any student is absent for any subject of Mid-term examination, an online test (CBT - Computer Based Test) will be conducted for him / her by the institute.

Semester End Examination (SEE)

The Semester End Examination (SEE) will be conducted for 70 marks consisting of Two parts i). **Part - A** for 20 marks ii). Part - B for 50 marks.

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

For Practical Courses

Continuous Internal Evaluation (CIE)

There shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 marks with a distribution of 20 marks for day-to-day evaluation and10 marks for internal lab exam. One internal practical test shall be conducted by the concerned laboratory teacher.

Semester End Examination (SEE)

SEE shall be conducted for 70 marks with an external examiner and the laboratory teacher concerned. The external examiner shall be appointed by the Chief Controller of Examinations of the college. The external examiner should be selected from the outside college among the autonomous / reputed institutions from a panel of three examiners submitted by the concerned BOS Chairman of the Department.

Engineering Graphics

- For the Subjects having Design and / or Drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation), the distribution shall be 30 marks for CIE (20 marks for day-to-day work and timely submission of drawing sheets and 10 marks for internal tests). There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for CIE.

- The distribution of marks for SEE shall be 70 marks. SEE shall consist of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub - questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

There shall be an Internship / Mini Project, in collaboration with an industry of their specialization. Students will register for this immediately after III year II semester (VI Semester) end examinations and pursue it during summer vacation. The evaluation of Mini project will be done at the end of IV Year I semester (VII semester). It shall be evaluated internally for 100 marks. The committee consisting of Project Coordinator, Supervisor of the project and one senior faculty of the department will evaluate the mini Project and award appropriate Grade, based on the report submitted to the department and presentation provided by the student in front of the committee.

Major Project - It shall be carried out in two stages

Project Stage – I shall be evaluated internally during IV Year I Semester, Project Stage – II shall be evaluated externally during IV Year II Semester. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester. First report includes project work carried out in IV Year I semester and second report include project work carried out in IV Year I & II Semesters. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.

(a) **For Project Stage – I,** the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall evaluate the project work for 70marks and project supervisor shall evaluate for 30 marks. Two reviews shall be conducted. Review-I will be conducted within a month from the commencement of class work (problem definition, objective, literature survey) and Review-II will be conducted before second mid examination (brief description and sample case study, progress of work, presentation and report submission). Average of the two reviews will be taken for 100 marks.

The student is deemed to have failed, if he (i) does not submit a report on Project Stage

- I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 40% marks. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such "one reappearance" evaluation also, he has to reappear for the same in the subsequent semesters, as and when it is scheduled. The topics for industrial oriented mini project,seminar and Project Stage – I shall be different from one another.

(b) **Project Stage – II** is the continuation of Project Stage – I. It shall be evaluated by the external examiner for 70 marks and the project supervisor shall evaluate it for 30 marks. Two reviews should be conducted. Review-I will be conducted within a month from the commencement of class work (progress of work, discussion and presentation) and Review-II will be conducted before second mid examination (progress of work, results, discussion, presentation and report submission). Average of the two reviews will be taken for CIE. The Project Viva-voce (SEE) shall be conducted by a committee comprising of an External Examiner, Head of the Department and Project Supervisor. In SEE marks, 20% for working model / simulation / data collection, 20% for report preparation and 60% for presentation and viva-voce. The external examiner should be selected by Chief Controller of Examinations / Principal from outside the college among the autonomous / reputed institutions from a panel of three examiners submitted by the concerned Head of the Department.

The student is deemed to have failed, if he / she (i) does not submit a report on Project Stage II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such “one reappearance” evaluation also, he / she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

Seminar

For Seminar presentation, the student shall collect the information on a specialized topic, prepare a Technical Report and submit to the department at the time of seminar presentation. The seminar presentation (along with the technical report) shall be evaluated by a committee consisting of Seminar coordinator and two senior faculty members with appropriate grade. The seminar report shall be evaluated internally for 100 marks. There shall be no semester end examination for the seminar.

Mandatory Non-Credit Courses

Mandatory Non-Credit Courses offered in any semester, a “Satisfactory / Not Satisfactory” shall be awarded to the student based on the performance in both CIE and SEE.

AWARD OF GRADES

Grades will be awarded to indicate the performance of students in each theory subject, laboratory / practicals, seminar, Industry Oriented Mini Project, and project Stage - I & II. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester

End Examination, both taken together) as specified in item 8.0 above, a corresponding letter grade shall be given**.**

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

% of Marks Secured in a Subject/Course (Class Intervals)	**Letter Grade (UGC Guidelines)**	**Grade Points**
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A^+ (Excellent)	9
70 and less than 80%	A (Very Good	8
60 and less than 70%	B^+ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Absent	0

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

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

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

A student earns grade point (GP) in each subject / course, on the basis of the letter grade secured in that subject / course. The corresponding "credit points" (CP) are computed by multiplying the grade point with credits for that particular subject / course.

Credit points (CP) = grade point (GP) x credits …. For a course

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

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

$$SGPA = \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{i=1}^{N} C_i}$$

For each semester,

where “i” is the subject indicator index (takes into account all subjects in a semester), “N” is thenumber of subjects “**registered”** for the semester (as specifically required and listed under the course structure of the parent department), C_i is the number of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

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

$$CGPA = \frac{\sum_{j=1}^{M} C_j G_j}{\sum_{j=1}^{N} C_j}$$

For all S semesters registered, (i.e., up to and inclusive of S semesters, S $\geq$2), where "**M**" is the total number of subjects (as specifically required and listed under the course structure of the parent department) the student has "registered" i.e., from the 1st semester onwards up to and inclusive of the 8th semester, "j" is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the number of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA

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

SGPA = 152 / 21 = 7.24

Illustration of calculation of CGPA up to 3rd semester

Semester	Course / Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course 1	3	A	8	24

I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15

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

CGPA = 518 / 69 = 7.51

The above illustrated calculation process of CGPA will be followed for each subsequent semester until VIII semester. The CGPA obtained at the end of VIII semester will be the final CGPA secured for entire B. Tech. Program for the student.

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

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

PASSING STANDARDS

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

After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, number of credits, grade earned, etc.), credits earned**.**

Declaration of results

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

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

% of Marks = (final CGPA – 0.5) x 10

AWARD OF DEGREE

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

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

Class Awarded	**CGPA to be Secured**	
First Class with distinction	≥ 7.50	**From the CGPA secured from 160 Credits**
First Class	≥ 6.50 and < 7.50	
Second Class	≥ 5.50 and < 6.50	
Pass Class	≥ 5.00 and < 5.50	
Fail	< 5.00	

WITHHOLDING OF RESULTS

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

STUDENT TRANSFERS

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

Transfer candidates (from non-autonomous college affiliated to JNTUH): A student who is following JNTUH curriculum, transferred from other college to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he / she had passed earlier and substitute courses are offered in their place as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUH for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits up to the previous semester under JNTUH regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

Transfer candidates (from an autonomous college affiliated to JNTUH): A student who has secured the required credits up to previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he / she had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester as per the regulations of the college from which he / she is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

SCOPE

The academic regulations should be read as a whole, for the purpose of any interpretation**.**
In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Council is final**.**

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

ACADEMIC REGULATIONS FOR B.TECH. (LATERAL ENTRY SCHEME) FROM THE ACADEMIC YEAR 2021 – 22

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

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

2. The student shall register for 121 credits and secure 121 credits with CGPA ≥ 5 from II year to IV year B.Tech. programme (LES) for the award of B.Tech. degree.

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

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

5. **Promotion Rule**

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

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will

hold good for B. Tech. (Lateral Entry Scheme).

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

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

3	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semesters. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with For feature of seat.

5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the chief superintendent / assistant superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination cancellation of their performance in subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinationsof the subjects of that semester. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the Course by the student is subject to the

		academic regulations in connection with forfeiture of seat.
8	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The student is also debarred and forfeits the seat.
9	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester examinations.

12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award a suitable punishment.	

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ACADEMIC CALENDAR (2023-24)

***Dusara Vacation (Subjected to declaration by JNTUH & TS Gov.**

CMR ENGINEERING COLLEGE
UGC AUTONOMOUS
(Approved by AICTE - New Delhi. Affiliated to JNTUH and Accredited by NAAC & NBA)
Kandlakoya (V), Medchal (M), Medchal - Malkajgiri (D)-501401

ACADEMIC CALENDAR (REVISED)
B.Tech III-YEAR: ACADEMIC YEAR (2023-24)

III B.Tech. I – SEMISTER

S. No.	EVENT	DATE FROM	DATE TO	DURATION
1	Commencement of Class Work	21.08.2023		---
2	First Spell of Instructions	21.08.2023	14.10.2023	8 weeks
3	**First Mid Term Examinations (Theory & Practical)**	***16.10.2023***	***21.10.2023***	***1 Week***
4	**Dusara Vacation***	***23.10.2023***	***28.10.2023***	***1 Week***
5	Submission of First Mid Term Marks to Exam Branch	30.10.2023		---
6	Parents Teacher's Meeting	04.11.2023		---
7	Second Spell of Instructions	30.10.2023	23.12.2023	8 weeks
8	**Second Mid Term Examinations (Theory & Practical)**	***26.12.2023***	***30.12.2023***	***1 Week***
9	Submission of Second Mid Term Marks to Exam Branch	06.01.2024		---
10	Preparation Holidays and Practical Examinations	01.01.2024	06.01.2024	1 week
11	**End Semester & Supplementary Examinations**	***08.01.2024***	***20.01.2024***	***2 Weeks***

III B.Tech. II – Semester

S. No.	EVENT	DATE FROM	DATE TO	DURATION
1	Commencement of II-SEM Class work	29.01.2024		---
2	First Spell of Instructions	29.01.2024	23.03.2024	8 weeks
3	**First Mid Term Examinations**	***26.03.2024***	***30.03.2024***	1 week
4	Submission of First Mid Term Marks to Exam Branch	06.04.2024		---
5	Parents Teacher's Meeting	13.04.2024		
6	Second Spell of Instructions	01.04.2024	11.05.2024	6 weeks
7	**Summer Vacation**	***13.05.2024***	***25.05.2024***	2 weeks
8	Continuation of Second Spell of Instructions	27.05.2024	08.06.2024	2 weeks
9	**Second Mid Term Examinations**	***10.06.2024***	***15.06.2024***	1 week
10	Submission of Second Mid Term Marks to Exam Branch	22.06.2024		---
11	Preparation Holidays and Practical Examinations	17.06.2024	22.06.2024	1 week
12	**End Semester & Supplementary Examinations**	***24.06.2024***	***06.07.2024***	***2 weeks***
13	Commencement of Class Work for the next A.Y-2024-2025	***08.07.2024***		---

- * **Dusara Vacation** (Subjected to declaration by JNTUH / TS Govt.)

Controller of Examination
CMR Engineering College
(Autonomous)
Kandlakoya (V), Medchal Dist.,
Hyderabad, T.S. - 501 401.

Controller of Examinations

Principal
CMR Engineering College
(Autonomous)
Kandlakoya (V), Medchal Dist.,
Hyderabad, T.S. - 501 401.

Principal

<u>Department planer (2023-24)</u>

1	03/07/2023	Commencement of Class Work for IV Year
2	21/08/2023	Commencement of Class Work for III Year
3	18/09/2023	Commencement of Class Work for II Year
4	03/07/2023-26/08/2023	I Spell of instructions for IV Year
5	21/08/2023-14/10/2023	I Spell of instructions for III Year
6	18/09/2023-18/11/2023	I Spell of instructions for II Year
7	30/10/2023	IV B.Tech Mini Project Work Review I
8	11.08.23	Student Workshop-I for IV Year
9	08.09.2023	Student Workshop-I for III Year
10	07/08/2023	Industrial visit
11	28/08/2023 - 02/09/2024	IV B.Tech Mini Project Work Review II
12	28/08/2023 - 02/09/2024	I MID Exams for IV Year
13	28/08/2023-31/08/2023	I MID Lab Internal Exam for IV Years
14	13/09/2024 - 14/09/2024	IV B.Tech Major Project Work Review I
15	08/09/2023	Guest lecture for III year
16	09/09/2023	Submission of I mid marks for IV Years to University
17	10/11/2023	IV B.Tech Mini Project Work Review II
18	16/10/2023-21/10/2023	I MID Exams for III Year
19	23/10/2023-21/10/2023	I MID Lab Internal Exam for III Year

20	23/10/2023-28/10/2023	Dussehra Recess
21	20/11/2023-25/11/2023	I MID Exams for II Year
22	21/11/2023-23/11/2023	I MID Lab Internal Exam for II Year
23	30/10/2023	Submission of I mid marks for III Years to University
24	02/12/2023	Submission of I mid marks for III Years to University
25	14/12/2023	Professional Body Activities
26	04/09/2023-04/11/2023	II Spell of instructions for IV Years (Including I mid examinations)
27	30/10/2023-23/12/2023	II Spell of instructions for III Years (Including I mid examinations)
28	27/11/2023-20/01/2024	II Spell of instructions for II Years (Including I mid examinations)
29	11/01/2024	IV B.Tech Mini Project Work Review III
30	06/11/2023 - 11/11/2023	II MID Exams for IV Years
31	06/11/2023 - 09/11/2023	II MID Lab Internal Exam for IV Years
32	13/11/2023 - 16/11/2023	Lab External Exam for IV Year
33	14/12/2023	Workshop for II year
34	15/11/2024 - 16/11/2024	IV B.Tech Major Project Work Review II
35	25/12/2023 - 30/12/2023	II MID Exams for III Years

36	22/01/2024 - 27/01/2024	II MID Exams for II Years
37	22/01/2024 - 24/01/2024	II Lab Internal Exam for II Year
38	29/01/2024 - 31/01/2024	Lab External Exam for II &III Year
39	01/02/2024 - 03/02/2024	Preparation Holidays and Practical Examinations
40	03/02/2024	Submission of II mid marks to University
41	05/02/2024 - 17/02/2024	End Semester Exams

LIST OF SUBJECTS/ LABS

S.No	Subject/lab name
1	Business Economics and Financial Analysis
2	Digital Image and Video processing
3	Electromagnetic Fields and Waves
4	Microprocessor and Microcontroller
5	Constitution of India
6	Digital Signal Processing lab
7	Microwave and optical communication lab

ACADEMIC PLANNER

On

Business Economics and Financial Analysis

Submitted by

Mrs. J.KALPANA

Assistant Professor

In the department of

ECE

CMR ENGINEERING COLLEGE

(Affiliated to J.N.T.U, HYDERABAD)

Kandlakoya(v),Medchal -501

(2022-2023)

S.NO	CONTENT
1	Preamble/Introduction
2	Prerequisites
3	Objectives and Outcomes
4	Syllabus (1.JNTUH 2. GATE 3. IES)

5	**List of Expert Details**
6	**Journals with min 5 ref paper for literature study**
7	**Subject -Lesson plan**
8	**Suggested Books (prescribed and References)**
9	**Websites for self-learning**
10	**Question Banks (1. JNTUH/Model papers 2.GATE)**
11	**Two case study presentations** **With Project / Product/ Model / prototypes/ Industrial applications.**
12	**Assignment Question/Innovative Assignments sets.**
13	**List of topics for students Seminars with Guidelines**
14	**STEP/Course material in softcopy**
15	**Expert Lectures with topics &Schedules (if any)**

(1) PREAMBLE/INTRODUCTION

Business economics financial analysis is the sub filed of economics .it helps to **in** establishing relationships between different economic factors, such as income, profits, losses, and market structure. While financial analysis uses market prices to check the balance of investment and the sustainability of project, economic analysis uses economic price that is converted from the market price by excluding tax, profit, subsidy, etc. to measure the legitimacy of using national resources to certain project.

(2) PREREQUISITES

Basic Concepts of Business Economics, Management & Concepts of Financial Accounting

(3) OBJECTIVES AND OUTCOME

Understand the concepts but apply them in real life by developing problem solving skills. Which are directly relevant to the practice of Management and decision making processes within an enterprise. There exists a relationship between Business Economics and Accounting and same is deal in the second part of the course. The focus here is on picking up the basics of Accounting Such as Accounting Data and Financial Statements, which constitute the language of Business?

The student is exposed and made familiar with generation, interpretation and use of Accounting Data.

COURSE OUTCOME:

C01	Define the economic techniques and concepts and Decide an action for Business
Co2	Explain Demand function to carry out efficient and productivity to and analysis of demand and supply
Co3	Develop production function to carry out efficient productivity and cost analysis to determine price of commodity and understand the market environment
Co4	Evaluate the basic accounting functions & make use of accounting .
Co5	Interpret the financial statements through ratio analysis for a company.

(4.1) SYLLABUS - JNTU

UNIT-I

OBJECTIVES

Define the economic techniques, concepts and decide an action for business objectives.

UNIT-I

<u>Introduction to business and economics</u>

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT - II

OBJECTIVES

Explain Demand function to carry out efficient and productivity to and analysis of demand and supply

DEMAND AND SUPPLY ANALYSIS

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT - III

OBJECTIVE

Develop production function to carry out efficient productivity
And cost analysis to determine price of commodity.

PRODUCTION, COST, MARKET STRUCTURES AND PRICING

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT - IV

OBJECTIVE

Evaluate the basic accounting functions & make use of accounting Principles for financial analysis

FINANCIAL ACCOUNTING

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT - V

OBJECTIVE

Interpret the financial statements through ratio analysis for a company

FINANCIAL ANALYSIS THROUGH RATIOS

Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems). Introduction to Fund Flow and Cash Flow Analysis (simple problems).

(4.2) SYLLABUS – GATE

NOT APPLICABLE

(4.3) SYLLABUS - IES

NOT APPLICABLE

5. LIST OF EXPERT DETAILS

The Expert Details which have been mentioned below are only a few of the eminent one known Internationally, Nationally and Locally. There are a few others known as well.

International

Dr.Rana singh Professor in Management & Associate Dean Centinum Institute

Rakesh Bhalla Vice- chairman ,NRIC of ICWA

National

Dr. D.Ganesh Rao - Prof. & Head, Deptt. of Telecommunication Engg., M.S. Ramayya Instt. of Tech., Bangalore

Prof. S.C. Dutta Roy, Deptt. of Electrical Engg., IIT, Delhi.

Mr. A.Nagoor Kani, 52, Seshachalam Street, Saidapet, Chennai**.**

Regional

Prof. N.S. Murthy, Dept. of ECE, NIT, Warangal.

Mr. K.V.Srinivasa Rao, HoD, Dept. of ECE, Aurora Engineering College, Bhongir, Nalgonda

6. JOURNALS WITH MIN 5 REF PAPER FOR LITERATURE STUDY

REF 1

HTTPS://WWW.RESEARCHGATE.NET/PUBLICATION/290430076_THE_IMPACT_OF_CORPORATE_CHARACTERISTICS_ON_THE_FINANCIAL_DECISIONS_OF_COMPANIES_EVIDENCE_ON_FUNDING_DECISIONS_BY_ITALIAN_SMES#PF4

REF2

HTTPS://WWW.SCIENCEDIRECT.COM/JOURNAL/JOURNAL-OF-ECONOMICS-AND-BUSINESS/VOL/115

REF3

HTTPS://WWW.SCIENCEDIRECT.COM/SCIENCE/ARTICLE/PII/S0148619520304136

REF4

HTTPS://WWW.SCIENCEDIRECT.COM/SCIENCE/ARTICLE/ABS/PII/S0148619517302308

REF5

HTTPS://WWW.JOURNALS.ELSEVIER.COM/JOURNAL-OF-FINANCIAL-MARKETS

7. SUBJECT -LESSON PLAN

BUSINESS ECONOMICS & FINANCIAL ANALYSIS					
S.NO	Topic	Sub-Topic	NO. OF LECTURES REQUIRED	Suggested Books	Remarks
		UNIT – I			
1	INTRODUCTIONTO BUSINESS AND ECONOMICS	Introduction and definition of Business	L1	T1	
2		Theory of firms.	L2	T1	

3		Types of Business entities and Sources of capital for a company	L3	T1	
4		Introduction of Economics and Significance of Economics	L4	T1	
5		Micro and Macro concepts	L5	T1	
6		National income concepts and Importance.	L6	T1	
7		Inflation and Money Supply in inflation.	L7	T1	
8		Features and Phases of Business Cycle.	L8	T1	
9		Nature and Scope of Business Economics and Role and Multidisciplinary nature	L9,L10	T1	

		UNIT - II			
10	DEMAND AND SUPPLY ANALYSIS	Introduction of Elasticity of Demand	L11,L12	T1	
11		Types of Elasticity and Law of Demand	L13	T1	
12		Measurement and significance of Elasticity of Demand	L14	T1	
13		Factors affecting Elasticity of Demand and good demand in decision making	L15,L16	T1	
14		Demand Forecasting: Characteristics and steps in Demand forecasting	L17	T1	
15		Methods in Demand forecasting	L18,L19	T1	

16		Supply Analysis: Introduction of Supply analysis and Determinants of Supply	L20,L21	T1	
17		Law of Supply and Functions	L22	T1	
		UNIT – III			
18	PRODUCTION,COST,MARKET STRUCTURE AND PRICING	Production Analysis: Factors of production and production function	L23	T1	
19		Production function with one variable input, two variable inputs, Return to scale	L24,L25,L26	T1	
20		Different types of production functions	L27,L28	T1	
21		Cost analysis: Types of cost, short run and long run function	L29,L30	T1	

22		Market structures: Introduction	L31,L32	T1	
23		Nature and competition of market structure	L33	T1	
24		Features of perfect competition, monopoly, oligopoly and monopolistic competition	L34	T1	
25		Pricing: Types of pricing, product life cycle based pricing.	L35,L36	T1	
26		Break even analysis, and cost volume profit analysis	L37	T1	
		UNIT – IV			
27	FINANCIAL ACCOUNTING	Accounting concepts and Conventions	L41	T1,R1	
28		Accounting Equation	L42	T1,R1	
29		Double-Entry Book Keeping.	L43	T1,R1	

30		Rules for maintaining Books of Accounts	L44	T1,R 1	
31		Journal, Ledger.	L45,L4 6	T1,R 1	
32		Trial Balance.	L47	T1,R 1	
33		Final Accounts	L48	T1,R 1	
		UNIT – V			
34	FINANCIAL ANALYSIS THROUGH RATIOS	Concept of Ratio Analysis	L49, L50	T1,R 1	
35		Liquidity Ratios	L51 ,L52	T1,R 1	
36		Turnover Ratios	L53 ,L54	T1,R 1	
37		Profitability Ratios	L55 ,L56	T1,R 1	
38		Proprietary Ratios	L57 ,L58	T1,R 1	
39		Solvency	L59 ,L60	T1,R 1	
40		Leverage Ratios (simple problems)	L61 ,L62	T1,R 1	

41		Introduction to Fund Flow and Cash Flow Analysis (simple problems	L63 ,L64	T1,R 1	

NOTE: **1.** Any Subject in a Semester is supposed to be completed in 55 to 65 periods.
2. Each Period is of 50 minutes.
3. Each unit duration & completion should be mentioned in the Remarks Column.
4. List of Suggested books can be marked with Codes like T1, T2, R1, R2 etc.

(8)Suggested Books (prescribed and References)

TEXT BOOKS

- T1 D. D. Chaturvedi, S. L. Gupta, Business Economics – Theory and Applications, International Book House Pvt. Ltd. 2013.
- T2 Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
- T3 Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012

REFERENCE BOOKS

- R1 Business economics and financial analysis Book by Dr. A. R. Aryasri
- *R2 Principles of Macroeconomics Textbook by N. Gregory Mankiw*

(9)WEBSITES FOR SELF-LEARNING

https://economictimes.indiatimes.com/definition/law-of-demand

http://www.economicsdiscussion.net/monopolistic-competition/price-and-output-determination-under-monopoly/4099

http://www.accountingnotes.net/final-accounts/problems-final-accounts/top-5-problems-on-final-accounts-of-the-companies/11284

(10) *QUESTION BANK*

UNIT-1

1. Define Business Economics. Explain its Nature And Scope.
2. Discuss the importance of Business Economics in decision making.
3. What is Business Economics? Explain its focus areas?
4. Point out the importance of Business Economics in decision making.
5. Define Business and Structure of business.
6. What are the different types of Business organizations?
7. What are the features of Sole trading form of Organization?
8. What are the characteristics of a Business Unit?
9. What are the characteristic features of a sole trader form of organization?
10. What are the salient features Partnership firm?
11. Explain Different kinds of partners.
12. What are the advantages and limitations of partnership firm?
13. What do you mean by Joint Stock Company? What are the salient features?
14. Describe the advantages and disadvantages of Joint Stock Companies.
15. What are the documents for Formation of Joint Stock Company?
16. What are the different types of companies in LLC?
17. Distinguish between the Joint Stock Company and Partnership.
18. Explain Theory of firms.
19. What are the different types of Business Entities?
20. What are limited liability companies?
21. What are sources of capital for a company?
22. Define Economics and importance of Economics.
23. Difference between Micro and macro Economics?
24. What are the Concepts of National Income? Explain Importance of National Income.
25. What is Inflation and types of inflation?
26. What is money supply in inflation and what are the types of Currencies?
27. Describe Business cycle and Features.
28. Illustrate phases of business cycle with diagram.
29. Define business economics, role in business.
30. Write Scope of business economics. How economics multi disciplinary with other discipline?

UNIT-II

1. Define elasticity of demand and measurement types of elasticity of demand.
2. Explain these terms? a) Law of supply b) production function c) fixed cost
3. What is meant by 'Elasticity of Demand'? How do you measure the elasticity of demand?
4. What is law of demand? Explain exceptions of law of demand.
5. Define demand. Write demand function with determinants.
6. Explain importance of elasticity of demand.
7. How Elasticity of demand use in decision making ?
8. Define 'Demand' and explain the factors that influence the demand of a product.
9. State the 'Law of Demand'. What are the various factors that determine the demand for a Mobile Phone.
10. Explain the concept of Cross Elasticity of Demand. Illustrate your answer with Examples.
11. Why does the Law of Diminishing Returns operate? Explain with the help of assumed data and also represent in a diagram.
12. What are the needs for Demand Forecasting? Explain the various steps involved in demand forecasting.
13. What are the possible approaches to forecasting demand for new products? Illustrate all the methods of Demand Forecasting?
14. Define supply and explain supply Function and Determinant.
15. Explain Law of supply.
16. Explain law of demand and expectations of law demand with curve.
17. Explain statistical method in demand forecasting.
18. Define expect opinion method in demand forecasting.

UNIT-III

1 Define production function with one variable input with example.

2 Define production Function. Discuss in detail the different types of production functions.

3 Explain the following with reference to production function.

4 Define ‘Cost’. How are costs classified? Explain any five important cost concepts useful for managerial decisions.

5 Discuss the role and importance of cost analysis in managerial decisions.

6 State and explain Break-Even analysis and explain its importance.

7 What are its limitations? Use suitable diagram? .

8 Define Market and explain how markets are classified.

9 Explain these terms.

10 a) What is perfect competition and its features?

b) What are the important features in Market structure?

11 How is market price determined under conditions of Perfect Market Competition?

12 Explain in detail, the important features of perfect competition.

13 How can a competitor attain equation position under conditions of perfect competition?

14 Explain the features of Monopoly.

15 What are the different market situations in imperfect competition?

16 Define production function with one variable input with example.

17 How can a Monopolist attain equilibrium position under conditions of monopoly?

18 What are the features of Monopolistic Competition? How can a firm attain equilibrium position?

19 Compare and contrast between Perfect competition and Monopoly.

20 Explain pricing and methods of pricing.

UNIT-IV

1. Give a brief account on the important records of Accounting under Double Entry System and discuss briefly the scope of each?
2. Explain the purpose of preparing the following accounts/statements and also elaborate the various items that appear in each of them. a) Trading Account b) Profit & Loss Account c) Balance Sheet
3. Explain the following concepts and illustrate their treatment with imaginary data. a) Depreciation?

a) Prepaid expenses b) Reserve for bad and Doubtful debts) Income received in advance

4. Explain the following adjustments and illustrate suitably with assumed data?

a) Closing stock b) Outstanding expenses c) Prepaid Income d) Bad debts

5. Define the concepts ‘Accounting’, Financial Accounting and Accounting System’?

6. Explain the main objectives of Accounting and its important functions.

7. What is three columnar cash book? What is Contra Entry? Illustrate

8. What do you understand by Double Entry Book Keeping? What are its advantages?

9. What is Trial Balance? Why it is prepared?

10. What are the different Concepts and Conventions of Financial Accounting?

11 Mr. Nirmal has the following transactions in the month of April.

Write Journal Entries for the transactions.

10th April :	Commenced business with a capital of 1,00,000
11th April :	Purchased goods from Veeru for 20,000
13th April :	Purchased Goods for Cash 15,000
14th April :	Purchased Goods from Abhiram for cash 9,000
16th April :	Bought Goods from Shyam on credit 12,000
17th April :	Sold goods worth 15,000 to Tarun
19th April :	Sold goods for cash 20,000
20th April :	Sold goods to Utsav for cash 6,000
21st April :	Sold goods to Pranav on credit 17,000
22nd April :	Returned goods to Veeru 3,000
23rd April :	Goods returned from Tarun 1,000
25th April :	Goods taken by the proprietor for personal use 1,000
26th April :	Bought Land for 50,000
27th April :	Purchased machinery for cash 45,000
28th April :	Bought computer from Intel Computers for 25,000
28th April :	Cash sales 15,000
29th April :	Cash purchases 22,000
30th April :	Bought furniture for proprietor's residence and paid cash 10,000

12) Calculate Trading account, P/L account and balance sheet

UNIT-V

1. Explain the meaning of the ‘Analysis of Financial Statementco5
2. Discuss briefly the different type of analysis.co5
3. Discuss the importance of Ratio Analysis for inter firm and intra-firm comparison, including circumstances responsible for its limitations, if any.co5
4. How are ratios classified for the purpose of financial analysis? With assumed data, illustrate any two types of ratios under each category?co5

5. Write a brief note on the importance of ratio analysis to different category of users.co5

6. As a financial analyst, what precautions would you take while interpreting ratios meaningfully?co5

7. What are the limitations of Ratio Analysis? Does ratio analysis really measure the financial performance of a company?c05

8. Following is the Profit and Loss account and Balance Sheet of Jai Hind Ltd. Calculate the following ratios:co5

a) Gross Profit Ratio b) Current Ratio c) Quick ratio

9) a) Calculate current ratio b) Quick Ratio c) Net working co5

10) Calculate funds flow statements? co5

11. TWO CASE STUDY PRESENTATIONS WITH PROJECT / PRODUCT/ MODEL / PROTOTYPES/ INDUSTRIAL APPLICATIONS.

Case study: 1

Coffee 2016

Coffee 2016 asks students to consider the coffee supply chain and generate ideas for what can be done to equalize returns across various stakeholders. The case draws a parallel between coffee and wine. Both beverages encourage connoisseurship, but only wine growers reap a premium for their efforts to ensure quality. The case describes the history of coffee production across the world, the rise of the "third wave" of coffee consumption in the developed world, the efforts of the Illy Company to help coffee growers, and the differences between "fair" trade and direct trade. Faculty has found the case provides a wide canvas to discuss supply chain issues, examine marketing practices, and encourage creative solutions to business problems.

Case study: 2
Ant financial

Faculty Supervision: K. Sudhir in cooperation with Renmin University of China School of Business

In 2015, Ant Financial's MYbank (an offshoot of Jack Ma's Alibaba company) was looking to extend services to rural areas in China by providing small loans to farmers. Microloans have always been costly for financial institutions to offer to the unbanked (though important in development) but MYbank believed that fintech innovations such as using the internet to communicate with loan applicants and judge their credit worthiness would make the program sustainable. Students are asked whether MYbank could operate the program at scale? Would its big data and technical analysis provide an accurate measure of credit risk for loans to small customers? Could MYbank rely on its new credit-scoring system to reduce operating costs to make the program sustainable?

12. ASSIGNMENT QUESTION SETS ON EACH UNIT

ASSIGNMENT -1

- What is Limited Liability Company and types of Limited Liability Company?(CO1)
- Explain wealth, welfare and Robbins Definition of economics. (CO1)
- Define business economics and nature, features and scope of business economics.(CO1)
- a)Explain law of demand exceptions of law of demand.(CO2)

  b)Explain Law of supply and determinates of law of supply.(CO2)
- Define production function and what is law of one variable production with assumed data table and graph. (CO3)

ASSIGNMENT-2

- Define market. Explain price output determination under monopoly. (CO3)
- Explain pricing methods of pricing. (CO3)
- Explain these items. (CO5)
- Write formulas of liquidity ratio.(CO5)
- What is double entry system, book keeping and advantages?(CO4)
- Performa of final accounts?(Trading account, profit and loss account, balance sheet)(CO4)
- The balance sheet of Punjab auto limited as on 31-12-2000 was as follows(CO5)

Particulars	Rs	Particulars	Rs
Equity share capital	40000	Plant and machinery	24000
capital reserve	8000	Land and building	40000
8 % loan on mortgage	32000	Furniture and fixtures	16000
Creditors	16000	Stock	12000

Bank overdraft	4000	Debtors	12000
Taxation	4000	investment (short term)	4000
Current	4000	cash in hand	12000
Future	4000		
profit and loss account	12000		
Toatal	1,20,000		1,20,000

From the above, compute

- The current ratio
- Quick ratio
- Debt equity ratio
- Proprietary ratio

11. IMPORTANT QUESTION SETS ON EACH UNIT

UNIT-I

SET-1

1. Define Business Economics.
2. Explain its Nature of Business economics
3. Discuss the importance of Business Economics in decision making.
4. Write scope of BE

SET-2

1.What is Limited Liability Company and types of Limited Liability Company?

2. Explain wealth, welfare and Robbins Definition of economics and concepts of economics.

3.Explain the role of a Business Economist in a Business Firm.

4. Define Business cycle and phases

SET-3

1. Explain about micro and macro economics
2. Write in brief about sources of capital for a company
3. Write about non conventional sources of finance
4. Explain concepts and importance national income

SET-4

1. Write in brief about structure of business firm
2. Write about partnership and types if partnerships.
3. Explain theory of firm and write about types of business entities
4. Define inflation and write about money supply in inflation

UNIT-II

SET-1

1. Define elasticity of demand and measurement types of elasticity of demand.
2. Explain the terms? a) Law of supply b) production function c) fixed cost
3. What is meant by 'Elasticity of Demand'? How do you measure it?
4. What is cross Elasticity of Demand? Explain.

SET-2

1. Explain the various factors influencing elasticity of demand
2. Explain the Measurements types of elasticity of demand.
3. How Elasticity of demand used in decision making.
4. Define 'Demand' and explain the factors that influence the demand of a product.

SET-3

1. State the 'Law of Demand'. What are the various factors that determine the demand for a Mobile Phone.

2.Explain the concept of Cross Elasticity of Demand. Illustrate your answer with Examples.

3. Why does the Law of Diminishing Returns operate? Explain with the help of assumed data and also represent in a diagram.

4. What are the needs for Demand Forecasting? Explain the various steps involved in demand forecasting?

SET-4

1.What are the possible approaches to forecasting demand for new products? Illustrate all the methods of Demand Forecasting?

2. Define supply and explain Law of supply.

3. Explain supply Function and Determinant.

4. Explain law of demand and expectations of law demand with curve.

UNIT-III

SET-1

1.Define production function with one variable input with example.

2.Define production Function. Discuss in detail the different types of production functions.

3. Explain the following with reference to production function

4. Define 'Cost'. How are costs classified? Explain any five important cost concepts useful for managerial decisions.

SET-2

1.Discuss the role and importance of cost analysis in managerial decisions

2.State and explain Break-Even analysis and explain its importance

3. What are its limitations? Use suitable diagrams?

4. Define Market and explain how markets are classified.

5. What are the important features in Market structure? a) What is perfect competition? What are its features

SET-3

1.How is market price determined under conditions of Perfect Market Competition.

2. Explain in detail, the important features of perfect competition.

3. How can a competitor attain equation position under conditions of perfect competition?

4. Explain the features of Monopoly.

5. What are the different market situations in imperfect competition?

SET-4

1. Define production function with one variable input with example.
2. How can a Monopolist attain equilibrium position under conditions of monopoly?
3. What are the features of Monopolistic Competition? How can a firm attain equilibrium position?
4. Compare and contrast between Perfect competition and Monopoly.

UNIT –IV

SET-1

1.Give a brief account on the important records of Accounting under Double Entry System and discuss briefly the scope of each.

2. Explain the purpose of preparing the following accounts/statements and also elaborate the various items that appear in each of them. a) Trading Account b) Profit & Loss Account c) Balance Sheet

3. Explain the following concepts and illustrate their treatment with imaginary data. a) Depreciation b) Prepaid expenses c) Reserve for bad and Doubtful debts d) Income received in advance.

4. Explain the following adjustments and illustrate suitably with assumed data.

Closing stock b) Outstanding expenses c) Prepaid Income d) Bad debts.

SET-2

1. Define the concepts 'Accounting', Financial Accounting and Accounting System'.
2. Explain the main objectives of Accounting and its important functions.
3. What is three columnar cash book? What is Contra Entry? Illustrate
4. What do you understand by Double Entry Book Keeping? What are its advantages?
5. What is Trial Balance? Why it is prepared?

SET-3

1. Explain the following concepts and illustrate their treatment with imaginary data. a) Depreciation B) Prepaid expenses c) Reserve for bad and Doubtful debts) Income received in advance.
2. What do you understand by Double Entry Book Keeping? What are its advantages?
3. Define accounting and write concepts and conventions of accounting.
4. Write in brief about rules of accounting?

SET-4

1. Write about double entry system?
2. Distinguish between trail balance and financial statement
3. Write about rules for maintaining books of accounts
4. Write about journal, ledger, trail balance and final account

UNIT-V

SET-1

1. Explain the meaning of the 'Analysis of Financial Statement.

2. Discuss briefly the different type of analysis
3. Discuss the importance of Ratio Analysis for inter firm and intra-firm comparison, including circumstances responsible for its limitations, if any.
4. How are ratios classified for the purpose of financial analysis? With assumed data, illustrate any two types of ratios under each category.

SET-2

1. Write a brief note on the importance of ratio analysis to different category of users.
2. As a financial analyst, what precautions would you take while interpreting ratios meaningfully.
3. What are the limitations of Ratio Analysis? Does ratio analysis really measure the financial performance of a company?
4. following is the Profit and Loss account and Balance Sheet of Jai Hind Ltd. Calculate the following ratios:

   a) Gross Profit Ratio b) Current Ratio c) Quick ratio

SET-3

1. Discuss briefly the different type of analysis.
2. Discuss the importance of Ratio Analysis for inter firm and intra-firm comparison, including circumstances responsible for its limitations, if any.
3. As a financial analyst, what precautions would you take while interpreting ratios meaningfully.
4. What are the limitations of Ratio Analysis? Does ratio analysis really measure the financial performance of a company?

SET-4

1. Following is the Profit and Loss account and Balance Sheet of Jai Hind Ltd. Calculate the following ratios:

   A) Gross Profit Ratio b) Current Ratio c) Quick ratio

2. Explain the meaning of the ‘Analysis of Financial Statement.

3. What are the limitations of Ratio Analysis? Does ratio analysis really measure the financial performance of a company?

4. Distinguish between funds flow and cash flow.

13. TOPICS FOR STUDENT’S SEMINARS

- Economics
- Business economics and managerial economics
- Firm, industry, organization
- Demand and supply
- National income
- Inflation, law of demand
- Elasticity of demand
- Production function
- Types of production
- Short run and long run cost functions
- Product life cycle based on pricing
- Break even analysis
- Cost volume profit analysis
- Demand forecasting
- Measurement and significance of elasticity of demand
- Perfect competition, monopoly, oligopoly, monopolistic competition
- Accounting concepts and conversations
- Accounting equation
- Double entry system of accounting
- Rules of books of accounts
- ledger, trail balance and final account
- Ratio analysis
- Liquidity ratio
- Turnover ratio
- Profitability ratio

- Proprietary ratio
- Solvency ratio

14. STEP/Course material in softcopy

BEFA.rar

15. Expert Lectures with topics &Schedules (if any)

EXPERT DETAILS

SASHIKANTH KOTAGIRI

MBA CPD& CTAA TRAINER 7 CAREER COACH

CONTACT NUMBER: 9912434241

Topic: External Market analysis about current issues in India

DIGITAL IMAGE & VIDEO PROCESSING

Subject Code: EC512PE

Class: III Year B.Tech ECE I Semester

BY

Y.PRASAD
ASSISTANT PROFESSOR

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

CMR ENGINEERING COLLEGE

S.NO	**CONTENT**
(1) -	**Preamble/Introduction**
(2) -	**Prerequisites**
(3) -	**Objectives and Outcomes**
(4) -	**Syllabus** **1.JNTU/R20-CMREC** **2.GATE** **3.IES**
(5) -	**List of Expert Details** (Local/National/International with Contact details/Profile link/Blogs/their research Contribution towards the subject)
(6) -	**Journals with min 5 ref paper for literature study**
(7) -	**Subject -Lesson plan**
(8) -	**Suggested Books (**prescribed and References)
(9) -	**Websites for self learning Resources like** *www.geeksforgeeks.org, www.schools.com, Coursera ,edX, Udemy, Khan Academy*, NPTEL etc along Registration procedures)
(10) -	**Question Banks** **1.JNTUH/Model papers** **2.GATE**
(11) -	**Two case study presentations with Project / Product/ Model /prototypes/ Industrial applications.**
(12) -	**Assignment Question/Innovative Assignments sets.**
(13) -	**List of topics for students Seminars with Guidelines**
(14) -	**STEP/Course material in softcopy**
(15) -	**Expert Lectures with topics & Schedules(if any)**

1. Preamble/Introduction:

Digital Image Processing is all about playing with pixels to obtain the desired outcome.(i.e. modification or creation of pixel data)
If one knows basic mathematics and optics (colourspaces and light spectrum) that should be sufficient to start learning. Knowing different signal processing techniques and mathematics topics relating to different transforms (Fourier, Laplace cosine etc) is an added advantage as you can learn faster and explore more.

Image processing is being applied in many fields in today's world,

- **Automotive sector**: In developing advanced drivers assist for semi-autonomous cars and also heavily used in autonomous/driver-less cars
- **Image enhancing:** The camera apps in smartphones and digital cameras using image processing to enhance the image quality, video stabilization and noise removal etc.
- **Robotics:** Mobile robot's navigation in unknown environment (SLAM), control of the robot by processing the video feed from the camera on robot to extract the live scene around it
- **Gaming:** Advanced gaming consoles like Xbox kinect uses image processing from motion analysis of the human player.
- **Problem specific solutions:** image processing is used as a solution to a variety of problems, starting from facial recognition access to defects identification in manufacturing industries
- **Manufacturing:** To identify defects in the processes and also to control the robots in performing certain tasks. for ex. defects in manufacturing of a Printed Circuit Board (PCB) can be observed using high resolution image processing
- **Human machine interface:** machines are made smart by adding gestural interface, or human action response interfaces, which decodes the actions of the human user to perform certain tasks.

2. Prerequisites:

This subject recommends basic knowledge & practice on

- Signals & Systems
- Digital Signal Processing
- Digital Communications
- Calculus And Probability
- Basic Programming Skills (MATLAB)

3.OBJECTIVE & OUTCOMES

This course introduced to learn the fundamental concepts of Digital Image Processing, to study basic image processing operations, to understand image analysis algorithms, to expose students to current applications in the field of Digital Image Processing.

COURSE OUTCOMES:

CO 1	Students will be able to describe the fundamental concepts of Digital Image Transforms
CO 2	Students will be able to understand Image enhancement in Spatial and Frequency domain,image restoration , image segmentation, Image compression,Image processing algorithms in MATLAB.
CO 3	Students will have the skill base necessary to further explore advance the topics of Digital Image Processing.
CO 4	Students will be in a position to make a positive profession contribution in the field of Digital Signal Processing.
CO 5	Students should have a clear impression of the breadth and practical scope of digital image processing and have arrived at a level of understanding that is the foundation for most of the work currently underway in this field..

4. SYLLABUS – JNTU-R20/UGC AUTONOMOUS

UNIT-I

OBJECTIVES

1. To define the scope of the field that we call image processing.
2. To give a historical perspective of the orgins in this field.
3. To give you an idea of the state of the art in image processing by examining some of the principal areas in which it is applied.
4. To discuss briefly the principal approaches used in digital image processing.
5. To give an overview of the components contained in a typical ,general-purpose image processing system,
6. To provide direction to the books and other literature where image processing work normally is reported.

SYLLABUS

Digital Image Processing Fundamentals & Image Transforms: Digital Image Fundamentals,Sampling and Quantization, Relationship between Pixels, **Image Transforms:2-D FFT,** properties, Walsh Transform, Hadamard transform, Discrete cosine transform, Haar transform, Slant transform, Hostelling transform.

UNIT – II

OBJECTIVES

1. To understand image enhancement in spatial domain.
2. To know the types of point operation, histogram manipulation.
3. To know about linear and non-linear gray level transformation.
4. To know about local or neighborhood operation, median filter, spatial domain high-pass filtering.
5. To understand image enhancement in frequency domain.
6. Obtaining frequency domain filters from spatial filters.
7. Generating filters directly in the frequency domain.
8. To know low pass and high pass filters in frequency domain.
9. To know degradation model, algebraic approach to restoration.
10. To know inverse filtering, least mean square filters
11. Constrained least squares restoration, interactive restoration

SYLLABUS

Image Enhancement (spatial domain): introduction, image enhancement in spatial domain, enhancement through point operation, types of point operation, histogram manipulation, linear and non-linear gray level transformation, local or neighborhood operation, median filter, spatial domain high-pass filtering.

Image Enhancement (frequency domain): filtering in frequency domain, obtaining frequency domain filters from spatial filters, Generating filters directly in the frequency domain, low pass (smoothing) and high pass(sharpening) filters in frequency domain.

Image Restoration Degradation model, algebraic approach to restoration, inverse filtering, and least mean square filters.

Constrained least squares restoration, interactive restoration

UNIT – III

OBJECTIVES

1. Understand the thresholding, region oriented segmentation.
2. To study morphological image processing, dilation and erosion.
3. To know dilation, structuring element decomposition.
4. To know erosion, combining dilation and erosion.
5. To study opening and closing.
6. To understand Hit or miss transformation.

SYLLABUS

Image segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, and region oriented segmentation.

Morphological Image Processing: dilation and erosion: dilation, structuring element decomposition, erosion, combining dilation and erosion, opening and closing, Hit or miss transformation.

Image Compression: redundancies and their removal methods, fidelity criteria, image compression models, Huffman and arithmetic coding, error free compression, lossy compression, lossy and lossless predictive coding,transform based compression,JPEG 2000 form

UNIT – IV

OBJECTIVES

1. To know the basics of video processing
2. To study Analog video and Digital video.
3. Understand the time varying image formation models..
4. To study three dimentional motion models.
5. To know geomentric image formation.
6. To know photometric image formation.
7. To study sampling of video signals.
8. To understand filtring operations.

SYLLABUS

Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT – V

OBJECTIVE

1. To understand the various motion techniques in video processing
2. To understand general methodologies.
3. To study pixel based motion estimation methods.
4. To know block matching algorithms.
5. To understand mesh based motion estimation.
6. To study region based motion estimation.
7. To study coding techniques.
8. To study Waveform based coding, Block based transform coding.
9. To study Application of motion estimation in Video coding

SYLLABUS

2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

5.List of Expert Details:

- Douglas V. Hall- State University of New York at Albany
  Phone: (503) 725-5396, Email: halld@pdx.edu
- A K Ray Ph.D.(IIT Kharagpur) Professor
  E-mail- ajoy_ray2004@yahoo.com
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  Phone: +91-512-2597198, Email: lbehera@iitk.ac.in
- Prof. Roopa R Kulkarni, GIT, Belgaum
  Email: roopa.patavardhan@gmail.com/roopakulkarni-ece@dsatm.edu.in

  Contact Number: +919880156678
- Dr.N. D. Tiwari, Professor, NRCM, Hyderabad
  Contact number: 9165437352

6 JOURNALS

1. Codruta O. Ancuti, Cosmin Ancuti,"Color Balance and Fusion for Underwater Image Enhancement", IEEE Transactions on Image Processing,Volume: 27 , Issue: 1 , pp: 379 – 393, Jan. 2018.
2. Qingsong Zhu, Jiaming Mai, Ling Shao," A Fast Single Image Haze Removal Algorithm Using Color Attenuation Prior", IEEE Transactions on Image Processing, Volume: 24 , Issue: 11 , pp: 3522 – 3533, Nov. 2015.

7 SUBJECT (LESSON) PLAN

S.NO	TOPIC TO BE COVERED	SUGGESTED BOOKS	NO OF LECTURERS

			REQ
UNIT-I			
1	Digital Image Fundamentals	T1,T2, R1	4
2	Sampling and quantization	T1,T2, R1	2
3	Relation between pixels,	T1,T2, R1	2
4	Image transforms 2-D FFT,properties,walsh transforms	T1,T2, R1	1
5	Walsh transform,Hadamard transform	T1,T2, R1	2
6	Discrete cosine transform,haar transform	T1,T2, R1	2
7	Slant transform,hotelling transform	T1,T2, R1	2
Total no of classes required: 15			
UNIT-II			
8	Image enhancement spatial domain introduction ,image enhancement in spatial domain,enhancement through point operation	T1,T2, , R1	4
9	Types of point operation,histogram manipulation	T1,T2, , R1	3
10	Linear and non linear gray level transformation local or neighborhood operation	T1,T2, , R1	3
11	Median filter spatial domain high pass filter	T1,T2, R1	3
Total no of classes required: 13			
UNIT-III			
12	Image restoration: degradation model algebraic approach to restoration	T2,T1, R1	3
15	Inverse filtering, least mean square filters	T2,T1, R1	3
16	Constrained least squares restoration,interactive restoration **Total no of classes required: 9**	T2,T1, R1	3
UNIT-IV			
17	Image segmentation:detection of continuities,edge linking and boundary detection	T1,R1	3
18	Thresholding, region oriented segmentation	T1,R1	3
19	Morphological image processing:dilation structuring element decomposition	T1,R1	2
20	Erosion ,combining dilation and erosion opening and closing,the hit or miss transform	T1,R1	3
Total no of classes required: 11			
UNIT-V			
21	Image compression redundencies and their removal methods	T1,R1	2
22	Fidelity criteria,image compression models	T1,T2, R1	3

23	Huffman and arithmetic coding,error free compression	T1,T2, R1	2
24	Lossycompression,lossy and lossless predictive coding	T1,R1	3
25	Transform based compression,JPEG 2000 standards	T1,R1	6

Total no of classes required: 16

8 SUGGESTED BOOKS

TEXT BOOKS:

T1. Digital Image Processing-Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008.

T2.. Digital Image Processing-S Jayaraman, S Esakkirajan, T veerakumar-TMH,2010.

REFERENCE KBOOKS:

R1. Digital Image Processing and analysis-Human and computer vision application with using CVIP Tools-scotte umbaugh,2nd edition,CRC press,2011

R2. Digital Image Processing using MATLAB- Rafael C. Gonzalez, Richard E. Woods and steven L.Eddings,2nd edition , TMH, 2010.

R3. Fundamentals of Digital Image Processing-A.K Jain,PHI, 1989

R4. Digital Image Processing and computer vision –somka , Hlavac , Boyle-cengage learning(Indian edition)2008.

R5.Introductory coputer Vision Imaging techniques and Solutions-adrian low, 2008,2nd edition.

R6.Introduction to Image processing & Analysis-John C. Russ, J Christian Russ, CRC Press,2010.

R7.Digital Image Processing with MATLAB &labview-vipula singh,Elsevier.

9 WEBSITES

Do not confine yourself to the list of websites mentioned here alone. Be cognizant and keep yourself abreast of the others too. The given list is not exhaustive.

- **https://nptel.ac.in/courses/117/105/117105079/**
- **https://www.youtube.com/watch?v=uvxtzxszdmk**
- **https://www.coursera.org/learn/digital**
- **http://nptel.ac.in/courses/117105079 /**
- **https://www.udemy.com/topic/image-processing/**
- **https://www.edx.org/learn/image-processing**

METHODS OF TEACHING

M1 : Lecture Method	**M6 : Tutorial**
M2 : Demo Method	**M7 : Assignment**
M3 : Guest Lecture	**M8 : Industry Visit**
M4 : Presentation /PPT	**M9 : Project Based**
M5 : Lab/Practical	**M10 : Charts / OHP**

10 QUESTION BANK

UNIT-I

Descriptive questions

1. Explain the steps involved in digital image processing?
2. Discuss about the following relationships between pixels with neat diagrams i)neighbors of a pixels? ii)connectivity iii)distance measures iv)path
3. Write the expressions for Walsh transforms kernel and Walsh transform(1D &2D)?
4. Briefly explain the forward and inverse transformation kernals of image transforms
5. Name and explain some important properties of 2-D DFT.
6. Discuss about the Slant tansform(1-D &2-D)
7. Discuss about the Hadamard tansform(1-D &2-D)
8. Discuss about the Haar tansform(1-D &2-D)
9. Discuss about the hotelling tansform(1-D &2-D)
10. State and prove separability property of 2D-FFT
11. State and prove the translation property.
12. State distributivity and scaling property.

UNIT-II

1. Explain smoothing spatial filters and nonlinear order static spatial filters.

2. Explain about Prewitt and sobel edge detectors.
3. Describe image histogram equalization.
4. Explain the method of using the second derivate for image sharpening by laplacian operator
5. What is high boost spatial fitering?compare it with high pass spatial fitering.
6. Discuss how the bit plane slicing is useful in image processing
7. Discuss the importance of a kernel or mask or window in spatial filtering used for enhancement of a digital image.
8. How does the spatial filter with name order static filter(non-linear filter)or median filter work?
9. What is meant by image enhancement by point processing?discuss any two methods in it.
10. Define histogram of a digital image.explain how histogram is useful in image enhancement.
11. Write about smoothing spatial filters.
12. What is meant by the gradiant and the laplacian?discuss their role in image enhancement.
13. Description of homomorphic fitering.
14. Expression for 2-D IHPF,expression for BHPF, expression for GHPF with sketches.explain their usefulness in image enhancement.
15. Expression for 2-D ILPF,expression for BLPF, expression for GLPF with sketches.explain their usefulness in image enhancement.
16. Expression for Butterworth low pass filter in frequency domain and discuss.
17. Compare the characteristics of low pass, high pass and homomorphic filters in image enhancement in frequency domain.
18. Discuss about ideal high pass filter and butter worth high pass filter.
19. Discuss about Gaussian high pass filter and Guassian low pass filter.
20. Explain how laplacian is implemented in frequency domain.
21. Write about high boost and high frequency filtering.

UNIT-III

1. Explain the method of least mean squares filtering for image restoration.
2. Explain model of image degradation/restoration process with a block diagram.
3. Explain the method of constrained least squares filtering for image restoration.
4. Explain three principle ways to estimate the degradation function for use in image restoration.
5. Discuss the process of image restoration by direct inverse filtering.
6. Write about noise probability density functions for all noise models.
7. Explain about iterative nonlinear restoration using the lucy-richardson algorithm.

UNIT-IV

1. What are the derivative operators useful in image segmentation?explain their role in segmentation
2. What is thresholding? Explain about global thresholing.
3. Explain about basic adaptive thresholding process used in image segmentation.
4. Explain in detail the threshold selection based on doundary characteristics.
5. Explain about the global processing via hough transform for edge linking.
6. Explain about the global processing via graph-theoritic techniques for edge linking.
7. Explain about region based segmentation.
8. What are the derivative operators useful in image segmentation?explain their role in segmentation.
9. Explain about region splitting and merging with an example.

UNIT-IV

1. Explain about fidelity criterion
2. Explain about image compression models
3. Explain a method of generating variable length codes with an example
4. Explain arithmetic encoding process with an example
5. Explain LZW coding with an example
6. Explain the concept of bit plane coding method
7. Explain about lossless predictive coding.

8. Explain adout lossy predictive coding
9. Explain with a block diagram about transform coding syatem
10. Explain about JPEG compression standard and the steps invovlved in JPEG compression.
11. How do find huffman coding for the given data

Original source symbol	a2	a6	a1	a4	a3	a5
probability	0.4	0.3	0.1	0.1	0.06	0.04

12. An 8 level image has the gray level distribution as given in the table. Compute the average pixel lenth for each code,compression ratio and relative redundancy.

rk	Pr(rk)	Code1	L1(rk)	Code2	L2(rk)
r87	0.25	01010111	8	01	2
r128	0.47	10000000	8	1	1
r186	0.25	11000100	8	000	3
r255	0.03	11111111	8	001	3

Code No: 117CJ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, March - 2017

DIGITAL IMAGE PROCESSING

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

Part- A (25 Marks)

1.a) Define image resolution. [2]

b) What are the steps involved in DIP? [3]

c) Specify the objective of image enhancement techniques. [2]

d) Differentiate between linear spatial filter and non-linear spatial filter. [3]

e) What is meant by image restoration? [2]

f) What is inverse filtering? [3]

g) Define region growing. [2]

h) What are the three types of discontinuity in digital image? **[3]**

i) Define huffman coding. [2]

j) What are different compression methods?

Part-B (50 Marks)

2.a) What is meant by digital image processing? What are the applications of it? How an image is represented digitally?

b) Non uniform sampling is useful for what type of images. Give reasons. [5+5]

OR

3.a) Is fast algorithm applicable for computation of Hadamard transform, if so what are the problems encountered in implementation.

b) Explain Discrete Cosine Transform and specify its properties. [5+5]

4.a) What is a histogram of an image? Sketch histograms of basic image types.

b) Discuss how histogram is useful for image enhancement. [5+5]

OR

5. What are the techniques used for image smoothing? Explain any one spatial and one frequency techniques used for image smoothing. [10]

6. Describe constrained least square filtering technique for image restoration and derive its transfer function. [10]

OR

7. Describe with mathematical model, both constrained and unconstrained restoration

8.a) Explain the segmentation techniques that are based on finding the regions.

b) Write the applications of segmentation. [7+3]

OR

9.a) Explain any two methods for linking the edge pixels to form a boundary of an object.

b) Explain with examples morphological operations dilation and erosion. [7+3]

10.a) Explain the schematics of image compression standard JPEG.

b) Draw and explain a general compression system model. [5+5]

OR

11.a) Describe in detail the lossless predictive coding error free compression.

b) Explain briefly the transform based compression. [5+5]

---ooOoo---

R13

Code No: 117CJ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, April/May - 2018

DIGITAL IMAGE PROCESSING

(Common to ECE, ETM)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B. Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub

questions.

PART- A

(25 Marks)

1.a) Define a digital image. [2]

b) Draw an image for image processing system. [3]

c) Present a note on smoothing linear filters. [2]

d) What are the applications of gray level slicing? [3]

e) Present a note on WEIGHT parameter. [2]

f) What are the spatial and frequency properties of noise? [3]

g) What are the applications of image segmentation? [2]

h) What is meant by watermarking? [3]

i) Define image compression. [2]

j) What is meant by error free compression? [3]

PART-B

(50 Marks)

2.a) Distinguish between digital image and binary image.

b) Explain a simple image model. [5+5]

OR

3.a) Explain the properties of slant transforrm.

b) Write short notes on hadamard transform. [5+5]

4. Explain image enhancement by point processing. [10]

OR

5.a) Explain about Ideal Low Pass Filter(ILPF) in frequency domain.

b) What is high frequency filtering? [5+5]

6.a) Write about component image observation model.

b) Discuss about Erlang noise. [5+5]

OR

7. Discuss about constrained and unconstrained restorations. [10]

8.a) Explain about Hough transform with an example.

b) What is the role of thresholding in segmentation? [5+5]

OR

9.a) Write short notes on dilation and erosion.

b) Give an overview of digital image watermarking methods. [5+5]

10. Discuss various image compression models. [10]

OR

11.a) Write a short note on fidelity criterion.

b) Explain Huffman coding technique. [5+5]

--ooOoo—

Code No: 117CJ **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, November/December - 2016

DIGITAL IMAGE PROCESSING

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Define Weber Ratio [2]

b) What is city block distance [3]

c) What is mean by Image Subtraction? [2]

d) What are Piecewise-Linear Transformations [3]

e) What is degradation function? [2]

f) What is Gray-level interpolation? [3]

g) What are the logic operations involving binary images [2]

h) What is convex hull? [3]

i) Define Compression Ratio [2]

j) What is Arithmetic Coding? [3]

PART-B

(50 Marks)

2.a) Discuss the role of sampling and quantization with an example.

j) With a neat block diagram, explain the fundamental steps in digital image processing.[5+5]

OR

3.a) Discuss the Relationship between Pixels in detail.

b) Discuss optical illusions with examples. [5+5]

4.a) State different types of processing used for image enhancement.

b) Explain in detail smoothing frequency-domain filters related to images. [5+5]

OR

5.a) Explain any two methods used for digital image zooming and shrinking.

b) Discuss two dimensional orthogonal unitary transforms. [5+5]

6.a) Discuss the minimum mean square error filtering.

b) Explain the model of image degradation process. [5+5]

OR

7.a) Discuss in detail the Inverse Filtering.

b) Write about Constrained Least Squares Restoration in detail. [5+5]

8.a) Write Edge Linking And Boundary Detection.

b) Write about detection of discontinuities. [5+5]

OR

9.a) Discuss the Region Oriented Segmentation.

b) Explain about Hit or Miss Transformation. [5+5]

10.a) Explain about Lossy and Lossless Predictive Coding

b) Explain about the methods of removal of redundancy. [5+5]

OR

11.a) Discuss the Transform Based Compression.

b) Write a short note on JPEG 2000 Standards. [5+5]

--ooOoo--

Code No: 117CJ **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, November/December - 2017

DIGITAL IMAGE PROCESSING

(Common to ECE, ETM)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

Part- A

(25 Marks)

1.a) Define Sampling and Quantization. [2]

b) List the properties of Walsh Transform. [3]

c) Define histogram. [2]

d) What is the need of image enhancement? [3]

e) What is the difference between image restoration and image enhancement? [2]

f) Draw the model of Image Restoration process. [3]

g) List different types of discontinuities in digital image. [2]

h) What is global, Local and dynamic threshold? [3]

i) What is the need of image compression? [2]

j) Give the characteristics of lossless compression. [3]

Part-B

(50 Marks)

k) With mathematical expressions explain the Slant transform and explain how it is useful in Image processing. [10]

OR

3.a) List and explain the fundamental steps in digital image processing.

6. Discuss briefly the following:

i) Neighbours of pixels ii) connectivity. [5+5]

4.a) Explain the use of histogram statistics for image enhancement.

b) How Gray level transformation helps in contrast enhancement? Discuss. [5+5]

OR

5.a) Compare and contrast spatial domain and frequency domain techniques of Image enhancement.

b) Discuss any one frequency domain technique of Image smoothing. [5+5]

6. What is meant by image restoration? Explain the image degradation model. [10]

OR

7. Discuss in detail the image restoration using inverse filtering. [10]

8.a) Explain the basics of intensity thresholding in image segmentation.

b) Explain about morphological hit-or-miss transform. [5+5]

OR

9.a) Discuss in detail the edge linking using local processing.

b) Discuss briefly the region based segmentation. [6+4]

10.a) Discuss briefly the Image compression using Huffman coding.

b) What is the importance of compression in Image processing? [7+3]

OR

11.a) Draw and explain the image compression model.

b) List and explain the steps involved in JPEG compression. [6+4]

12 TUTORIAL QUESTIONS

UNIT-I

1. Explain the steps involved in digital image processing?
2. Discuss about the following relationships between pixels with neat diagrams

i)neighbors of a pixels? ii)connectivity iii)distance measures iv)path

3. Write the expressions for Walsh transforms kernel and Walsh transform(1D &2D)?
4. Briefly explain the forward and inverse transformation kernals of image transforms
5. Name and explain some important properties of 2-D DFT.
6. Discuss about the Slant tansform(1-D &2-D)
7. Discuss about the Hadamard tansform(1-D &2-D)
8. Discuss about the Haar tansform(1-D &2-D)
9. Discuss about the hotelling tansform(1-D &2-D)
10. State and prove separability property of 2D-FFT
11. State and prove the translation property.
12. State distributivity and scaling property.

UNIT-II

1. Explain smoothing spatial filters and nonlinear order static spatial filters.
2. Explain about Prewitt and sobel edge detectors.
3. Describe image histogram equalization.
4. Explain the method of using the second derivate for image sharpening by laplacian operator
5. What is high boost spatial fitering?compare it with high pass spatial fitering.
6. Discuss how the bit plane slicing is useful in image processing
7. Discuss the importance of a kernel or mask or window in spatial filtering used for enhancement of a digital image.
8. How does the spatial filter with name order static filter(non-linear filter)or median filter work?
9. What is meant by image enhancement by point processing?discuss any two methods in it.
10. Define histogram of a digital image.explain how histogram is useful in image enhancement.
11. Write about smoothing spatial filters.
12. What is meant by the gradiant and the laplacian?discuss their role in image enhancement.
13. Description of homomorphic fitering.
14. Expression for 2-D IHPF,expression for BHPF, expression for GHPF with sketches.explain their usefulness in image enhancement.
15. Expression for 2-D ILPF,expression for BLPF, expression for GLPF with sketches.explain their usefulness in image enhancement.
16. Expression for Butterworth low pass filter in frequency domain and discuss.
17. Compare the characteristics of low pass, high pass and homomorphic filters in image enhancement in frequency domain.
18. Discuss about ideal high pass filter and butter worth high pass filter.
19. Discuss about Gaussian high pass filter and Guassian low pass filter.
20. Explain how laplacian is implemented in frequency domain.
21. Write about high boost and high frequency filtering.

UNIT-III

1. Explain the method of least mean squares filtering for image restoration.
2. Explain model of image degradation/restoration process with a block diagram.
3. Explain the method of constrained least squares filtering for image restoration.
4. Explain three principle ways to estimate the degradation function for use in image restoration.
5. Discuss the process of image restoration by direct inverse filtering.
6. Write about noise probability density functions for all noise models.
7. Explain about iterative nonlinear restoration using the lucy-richardson algorithm.

UNIT-IV

10. What are the derivative operators useful in image segmentation?explain their role in segmentation
11. What is thresholding? Explain about global thresholing.
12. Explain about basic adaptive thresholding process used in image segmentation.
13. Explain in detail the threshold selection based on doundary characteristics.
14. Explain about the global processing via hough transform for edge linking.
15. Explain about the global processing via graph-theoritic techniques for edge linking.
16. Explain about region based segmentation.
17. What are the derivative operators useful in image segmentation?explain their role in segmentation.
18. Explain about region splitting and merging with an example.

UNIT-V

1. Explain about fidelity criterion
2. Explain about image compression models
3. Explain a method of generating variable length codes with an example
4. Explain arithmetic encoding process with an example
5. Explain LZW coding with an example
6. Explain the concept of bit plane coding method
7. Explain about lossless predictive coding.
8. Explain adout lossy predictive coding
9. Explain with a block diagram about transform coding syatem
10. Explain about JPEG compression standard and the steps invovlved in JPEG compression.
11. How do find huffman coding for the given data

Original source symbol	a2	a6	a1	a4	a3	a5
probability	0.4	0.3	0.1	0.1	0.06	0.04

12. An 8 level image has the gray level distribution as given in the table. Compute the average pixel lenth for each code,compression ratio and relative redundancy.

rk	Pr(rk)	Code1	L1(rk)	Code2	L2(rk)
r87	0.25	01010111	8	01	2
r128	0.47	10000000	8	1	1
r186	0.25	11000100	8	000	3
r255	0.03	11111111	8	001	3

13 Continuous assessment program (CAP):

UNIT-1 : INTRODUCTION TO DIGITAL IMAGE PROCESSING

1.the amount of luminous flux falling on a given area of surface is called as ____________

(a)Aperture

(b)contrast

(c)brightness

(d)I luminance

2.Digitization of spatial co-ordinates (x,y)is called

(a)gray level quantization

(b)finite sampling

(c)image sampling

(d)image quantization

3.a 128X128 image with 64 gray levels requires ________bits of storage

(a)4096

(b)8192

(c)12288

(d)98304

4.a good image is difficulty to define because image quality

(a)high subjective ,weakly dependent

(b)lowly subjective, weakly dependent

(c)high subjective ,strongly dependent

(d)lowly subjective, strongly dependent

5.for coordinates **p(2,3)**the 4 neighbors of pixel **p** are

(a)(3,3)(2,3)(1,3)(1,3)

(b)(3,3)(2,3)(1,1)(2,2)

(c)(3,3)(2,4)(1,3)(2,2)

(d)(3,3)(2,4)(1,3)(2,1)

6.D distance is also called as

(a)city block distance

(b)chess board distance

(c)Euclidean distance

(d)mean distance

7.image transforms are needed for

(a)conversion information form spatial to frequency

(b)spatial domain

(c)time domain

(d)both b&c

8.image restoration is used to improve the **________**image

(a)quantity

(b)quality

(c)blur

(d)none

9.the walsh and hadamard transforms are ____________in nature

(a)sinusoidal

(b)cosine

(c)non-sinusoidal

(d)cosine and sine

10.unsampling is a process of _____________the spatial resolution of the image

(a)decreasing

(b)increasing

(c)averaging

(d)doubling

UNIT-2 : INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING

1. Which of the following make an image difficult to enhance?
a) Narrow range of intensity levels
b) Dynamic range of intensity levels
c) High noise
d) All of the mentioned

2. Which of the following is a second-order derivative operator?
a) Histogram
b) Laplacian
c) Gaussian
d) None of the mentioned

3. Response of the gradient to noise and fine detail is _____________ the Laplacian's.
a) equal to

b) lower than
c) greater than
d) has no relation with

4. Dark characteristics in an image are better solved using ____________________.
a) Laplacian Transform
b) Gaussian Transform
c) Histogram Specification
d) Power-law Transformation

5. What is the smallest possible value of a gradient image?
a) e
b) 1
c) 0
d) -e

6. Which of the following fails to work on dark intensity distributions?
a) Laplacian Transform
b) Gaussian Transform
c) Histogram Equalization
d) Power-law Transformation

7. _________________________ is used to detect diseases such as bone infection and tumors.
a) MRI Scan
b) PET Scan
c) Nuclear Whole Body Scan
d) X-Ray

8. How do you bring out more of the skeletal detail from a Nuclear Whole Body Bone Scan?
a) Sharpening
b) Enhancing
c) Transformation
d) None of the mentioned

9. An alternate approach to median filtering is ______________
a) Use a mask
b) Gaussian filter
c) Sharpening
d) Laplacian filter

10. Final step of enhancement lies in ________________ of the sharpened image.
a) Increase range of contrast
b) Increase range of brightness
c) Increase dynamic range
d) None of the mentioned

FILTERING IN THE FREQUENCY DOMAIN

1.idel low pass filters has the transfer function is ___________________

2.draw the mask for sobel or prewitt or roberts operator________________

3.what is the transfer function of Butterworth high pass filter______________

4.draw the frequency response of high pass filter____________

5.band pass filter is a combination of high pass & low pass_ filters.

6.write the equation for 2-D Fourier transform______________________

7.write any one property of fourier transform_______________

8.steps followed in homomorphic filtering

1.______ 2.________ 3.________ 4._________ 5.________

9.butterworth filter has ____________transition

a. smooth

b. sudden

c. paek

d. b&c

10.these are the noises that are not random ,but very systematic errors

a .artefacts noise

b. salt&pepper noise

c. Gaussian noise

d. white noise

UNIT-3 : IMAGE RESTORATION AND RECONSTRUCTION

1.image restoration is to improve the _______________of the image

a.quality

b.noise

c.intensity

d.colour

2.draw the degradation model of the image______________

3.write the inverse filtering formulation_________________

4.due to uniform linear motion image is__________________

a. blurred

b. sharpened

c. smoothened

d. a & c

5.write the inverse filter response formulation **Ans : $g(x,y)=f(x,y)*h(x,y)+n(x,y)$**

6.write the geometric mean filter response________________

7.write down the radon transform_______________________

8.abrivate "CT" scanner ______________________________

9.Blur is characterized by the ________________ response of the system

a. filter

b. noise

c. impulse

d. image

10.Objective fidelity is the image quality characterization using metrics such as errors and SNR

11.subjective fidelity is an intuitive way of assessing image quality using the human visual system

UNIT-4 :IMAGE SEGMENTATION

1.________________is process of partition the digital image in to multiple regions

a.merging

b.filling

c.splitting

d.transform

2.__________is set of connected pixel that lie on the boundary between two regions.

a.point

b.edge

c.colour

d.line

3.the objective of the sharpening filter is _________

a.highlight the intensity transitions

b. highlight the low transitions

c.highlight the bright transitions

d. highlight the colour transitions

4._____________has number of peaks

a.bimodel histogram

b.multimodel histogram

c.histogram

d.image

5.____________is the starting pixel of region growing process.

a.seed pixel

b.base pixel

c.original pixel

d.image

6.___________is a deformable model that fits a model for segmenting ROI

a.tiger

b.snake

c.goat

d.image

7._______________is the position of sign change of the first derivative among neighboring points

a.edge

b.zero-crosing

c.point

d.line

8._________ has unimodel histogram

a.one pixel

b.one peak

c.one valley

d.one intensity level

9.abrivate ROI_______________

a.region of image

b.region of interest

c.region of indicator

d.restoration of image

10.the hough transform is used to fit points as _________________

a.line

b.edge

c.curve

d.ROI

MORPHOLOGICAL IMAGE PROCESSING

1.image morphology is an important tool in extraction of image _____________

a.features

b.colour

c.intensities

d.nature

2.the difference between the original image and the eroded is creates__________

a. higher level gray levels

b low lever gray level

c. boundary

d. unfilled regions

3.tap-hat transform is used for ____________

a. highlighting the bright peaks

b. highlighting the dark peaks

c. highlighting the bright and dark peaks

d. highlighting the dark and bright peaks

4.the theory of mathematical morphology is based on______________

a. image size

b. set theory

c. probability

d. correlation

5.well transform is used for ____________

a. highlighting the bright peaks

b. highlighting the dark peaks

c. highlighting the bright and dark peaks

d. highlighting the dark and bright peaks

6.thinning operation is used to remove the _________pixels

a.foreground

b.back ground

c.object

d.image

7.morphlogical gradient gives__________

a. transition from spatial to frequency

b. transition from dark to bright

c. transition from frequency to spatial

d.none

8.structering element is a ______________

a.mask

b.colour

c.background

d.pixel

9.____________is a process of removing of the extra tail pixels in an image

a.erosion

b.dilation

c.hit-miss transform

d.pruning

10.whatershed is process of ______________ the object

a.histogram

b.locating

c.transform

d.highliting

<u>SEMINAR TOPICS</u>

1. Digital image fundamentals & image tramsforms.
2. Image enhancement spatial domain and frequency domain.
3. Image restoration

4. Haar transform
5. Hotelling transform
6. Median filter spatial domain high pass filtering
7. Constrained least squares restoration
8. Interactive restoration
9. Thresholding
10. Region oriented segmentation
11. Combining dilation and erosion
12. The hit or miss transformation.
13. Lossy and lossless predictive coding
14. Transform based compression
15. JPEG 2000 standards

(14) - STEP/Course material in softcopy

DIP.zip

(15) Expert Lectures with topics & Schedules(if any

ALL THE BEST

GROUP OF INSTITUTIONS

EXPLORE TO INVENT

ACADEMIC PLAN
FOR
ACADEMIC YEAR
2022-23

COURSE:III YEARB.TECH ECE-II-SEM-R18

SUBJECT: Digital Signal Processing

CREDITS:4

ACADEMIC PLANNER
Subject: Digital Signal Processing

S.NO **CONTENT**

(1) - **Preamble/Introduction**
(2) - **Prerequisites**
(3) - **Objectives and Outcomes**
(4) - **Syllabus**
1. JNTU/R20-CMREC
2. GATE
3. IES
(5) - **List of Expert Details** (Local/National/International with Contact details/Profile link/Blogs/their research Contribution towards the subject)
(6) - **Journals with min 5 ref paper for literature study**
(7) - **Subject -Lesson plan**
(8) - **Suggested Books (**prescribed and References)
(9) - **Websites for self learning Resources like** (www.geeksforgeeks.org, www.schools.com, Coursera,edX, Udemy, Khan Academy, NPTEL etc along Registration procedures)
(10) - **Question Banks**
1.JNTUH/Model papers
2. GATE
(11) - **Two case study presentations with Project / Product/ Model /prototypes/ Industrial applications.**
(12) - **Assignment Question/Innovative Assignments sets.**
(13) - **List of topics for students Seminars with Guidelines**
(14) - **STEP/Course material in softcopy**
(15) - **Expert Lectures with topics & Schedules(if any)**

(1) PREAMBLE/INTRODUCTION:

Signals analysis is very important in daily life. Hence it is required to study the different signals (continuous and discrete) and their properties. The behavior of the signals in time and frequency domain is important in analyzing the response of the network. The tools like FFT, DFT, Z– transforms may be used in the analysis of the signals. Filters must be required to eliminate the unwanted signals. Hence digital filter design also required to be studied. Sampling of signals is required to convert continuous to discrete signals. To have knowledge on the implementation signals, DSP processors must be studied.

(2) PREREQUISITES:

Signals and Systems

(3) COURSE OBJECTIVE AND OUTCOMES:

Digital signal processing is the processing of digitized discrete-time sampled signals. Processing is done by general-purpose computers or by digital circuits such as ASICs, field-programmable gate arrays or specialized digital signal processors (DSP chips). Typical arithmetical operations include fixed-point and floating-point, real-valued and complex-valued, multiplication and addition. Other typical operations supported by the hardware are circular buffers and look-up tables. Examples of algorithms are the Fast Fourier transform (FFT), finite impulse response (FIR) filter, Infinite impulse response (IIR) filter, and adaptive filters such as the Wiener and Kalman filters. The following areas covered using the digital signal Processing are

- Statistical signal processing
- Spectral estimation
- Speech signal processing
- Image processing
- Video processing
- Array processing
- Time-frequency analysis
- Filtering
- Seismic signal processing
- Data mining
- Financial signal processing

PROGRAM EDUCATION OUTCOMES

a. Graduates will demonstrate knowledge of mathematics, science and engineering.
b. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.
c. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.
d. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.
e. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.
f. Graduate will demonstrate skills to use modern engineering tools, softwares and equipment to analyze problems.
g. Graduates will demonstrate knowledge of professional and ethical responsibilities.
h. Graduate will be able to communicate effectively in both verbal and written form.
i. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
j. Graduate will develop confidence for self education and ability for life-long learning.
k. Graduate who can participate and succeed in competitive examinations.

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, social, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
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(PSO'S)

1. Ability to apply concepts of Electronics & Communication Engineering to associated research areas of electronics, communication, signal processing, VLSI, Embedded systems
2. Ability to design, analyze and simulate a variety of Electronics & Communication functional elements using hardware and software tools along with analytic skills

Course Name: Digital Signal Processing (EC602PC**)**

EC602PC.**1**	**Understand** the LTI system characteristics and Multirate signal processing.
EC602PC.**2**	**Understand** the inter-relationship between DFT and various transforms.
EC602PC.**3**	**Design** a digital IIR filter for a given specifications.
EC602PC.**4**	**Design** a digital FIR filter for a given specifications.
EC602PC.**5**	**Understand** the significance of various filter structures and effects of round off errors.
EC602PC.**6**	**Compare** the tradeoffs between normal and multi rate DSP techniques and can explore the finite length word effects. **Perform** time, frequency, and Z -transform analysis on signals and systems.

CO-PO Matrix:

Course Outcomes (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC602PC.**1**	3	3	2	2		-	-	-	-	-	3	-
EC602PC.**2**	3	3	3	2	-	-	-	-	-	-	3	-

EC602PC.**3**	3	3	3	2	-	-	-	-	-	-	3	2
EC602PC.**4**	3	3	3	2	-	-	-	-	-	-	3	2
EC602PC.**5**	3	3	2	2	-	-	-	-	-	-	3	2
EC602PC.**6**	3	2	1	2	-	-	-	-	-	-	3	2

Course Outcome (CO)-Program Specific Outcome (PSO) Matrix:

Course Outcomes (CO's)	PSO1	PSO2
EC602PC.**1**	3	3
EC602PC.**2**	3	3
EC602PC.**3**	3	3
EC602PC.**4**	3	3
EC602PC.**5**	3	3
EC602PC.**6**	2	2

SCOPE:

Signal processing is an area of systems engineering, electrical engineering and applied mathematics that deals with operations on or analysis of analog as well as digitizedsignals, representing time-varying or spatially varying physical quantities. Signals of interest can include sound, electromagnetic radiation, images, and sensor readings, for example biological measurements such as electrocardiograms, control system signals, telecommunication transmission signals, and many others

(4) SYLLABUS:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

III YEAR B.TECH ECE-II SEML/T/PC

3/1/-4

Digital Signal Processing

UNIT-I

Introduction: Introduction to DSP,Discrete time signals &Sequences, conversion of continuous to discrete signal, Normalized frequency,Linear shift invariant systems, stability,Causality, Linear constant coefficient difference equations,Frequency domain representation of discrete time signals and systems.

Multi rate digital signal processing: Multi rate digital signal processing introduction,Down sampling, decimation,Up sampling, interpolation,Sampling rate conversion.

UNIT-II

Discrete Fourier series: Fourier Series, Fourier Transform, Laplace Transform and Z-Transformrelation, DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, DiscreteFourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation ofDFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and ZTransform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT), Radix-2 DIT FFT, DIF FFT, Inverse FFT, FFT with general radix-N

UNIT-III

IIR digital filters: Analog filter approximations-Butterworth, chebychev,Design of IIR digital filters from Analog filters,Step & Impulse invariant method,Bilinear transformation method,Spectral transformations

UNIT-IV

FIR digital filters: Characteristics of FIR digital filters, frequency response,Design of FIR filters using Fourier method,Digital filters using Window techniques,Frequency Sampling technique,Comparison of IIR & FIR filters

UNIT-V:

Realization of digital filters: Application of Z-transforms,Solution of difference equations of digital filters,System function, Stability criterion,Frequency response of stable systems,Realization of digital filters-Direct, canonic, cascade and parallel forms

Finite word length effects: Finite word length effects,Limit cycles, over flow oscillations, round off noise in IIR digital filters,Computational output round off noise, methods to prevent over flow,Trade off between round off and overflow noise,Measurement of coefficient quantization effects through pole-zero movement,Dead band effects.

TEXT BOOKS:

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

REFERENCES:

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

GATE SYLLABUS:
Electronics and Communications Engineering: Signals and Systems

Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, digital filter design techniques.

IES SYLLABUS:

Electronics and Tele Communications Engineering: Systems and Signal Processing

Systems and Signal Processing : Representation of continuous and discrete-time signals, shifting and scaling operations, linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier and Laplace transform, Z transforms, Discrete Fourier, transform, FFT, linear convolution, discrete cosine transform, FIR filter, IIR filter, bilinear transformation.

(5) SUJECT EXPERTS DETAILS:

REGIONAL:

1. Dr. Nukala Suryanarayana Murthy B.E,M.S,Ph.D
   Professor
   Vasavi College of Engineering
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1. Dr. Neelakandan Rajamohan
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Simula Research Laboratory, Norway
Contact Number:+47 465 65 641
Url:https://scholar.google.com/citations?user=8H5s9vEAAAAJ&hl=en

(6) JOURNAL WITH MIN 5 REF PAPERS FOR LITERATURE SURVEY STUDY:

1.https://ieeexplore.ieee.org/document/1614066/authors#authors

Title: Compressed sensing

2. https://ieeexplore.ieee.org/document/482137

Title: Splitting the unit delay [FIR/all pass filters design]

3. https://ieeexplore.ieee.org/document/109205

Title: Frequency-domain and multirate adaptive filtering

4.https://ieeexplore.ieee.org/document/1161901

Title: The use of fast Fourier transform for the estimation of power spectra: A method based on time averaging over short, modified periodograms.

5.https://ieeexplore.ieee.org/document/1162619

Title:A new hardware realization of digital filters

(7) Lesson Plan

Name of the topic	Sub topics	No. of classes	Text books	Remarks
	UNIT I			
Introduction	Introduction to DSP	L1	T1,R1	1
	Discrete time signals &Sequences, conversion of continuous to discrete signal,	L2,L3	T1,R1	1
	Normalized frequency, Linear shift	L4,L5	T1,R1	1

	invariant systems, stability			
	Causality, Linear constant coefficient difference equations	L6,L7	T1,R1	1
	Frequency domain representation of discrete time signals and systems	L8,L9	T1,R1	2
	Multi rate digital signal processing introduction	L10	T1,R1	1
	Down sampling, decimation	L11	T1,R1	1
	Up sampling, interpolation	L12	T1,R1	1
	Sampling rate conversion	L13	T1,R1	1
	Conversion of band pass signals	L14	T1,R1	1
	concept of resampling	L15	T1,R1	1
	Applications of multi rate signal processing	L16	T1,R1	1
		No. of classes required		**12**
		UNIT II		
Discrete Fourier Series	DFS representation, Properties	L17,L18	T1,R1,T2	2
	DFT, Properties	L19,L20	T1,R1,T2	2
	Linear Convolution of sequences using DFT	L21	T1,R1,T2	1
	Overlap add method, Overlap save method	L22,L23	T1,R1,T2	2
	Relation between DTFT,DFS,DFT and Z-Transform	L24	T1,R1,T2	1
Fast Fourier Transforms	Fast Fourier Transforms(FFT)	L25,L26	T1,R1,T2	1
	Radix-2 DIT FFT	L27,L28	T1,R1,T2	1
	DIF FFT	L29,L30	T1,R1,T2	1
	Inverse FFT	L31	T1,R1,T2	1
	FFT with general radix-N	L32	T1,R1,T2	1
		No. of classes required		**12**
		UNIT III		
IIR digital filters	Analog filter approximations-Butterworth, chebychev	L33,L34	T1,R1	2
	Design of IIR digital filters from analog filters	L35,L36	T1,R1	2
	Step & Impulse invariant method	L37	T1,R1	1
	Bilinear transformation method	L38,L39	T1,R1	2
	Spectral transformations	L40	T1,R1	1
		No. of classes required		**8**
		UNIT IV		
FIR digital filters	Characteristics of FIR digital filters, frequency response	L41,L42	T1,R1	2
	Design of FIR filters using Fourier method	L43,L44	T1,R1	1

	Digital filters using Window techniques	L45,L46	T1,R1	2
	Frequency Sampling technique	L47	T1,R1	1
	Comparison of IIR & FIR filters	L48	T1,R1	1
No. of classes required				**8**
UNIT V				
Realization of digital filters	Application of Z-transforms	L49,L50	T1,R1	2
	Solution of difference equations of digital filters	L51	T1,R1	1
	System function, Stability criterion	L52	T1,R1	1
	Frequency response of stable systems	L53 ,L54	T1,R1	1
	Realization of digital filters-Direct, canonic, cascade and parallel forms	L55,L56	T1,R1	2
Finite word length effects	Finite word length effects	L57	T1,R1	1
	Limit cycles, over flow oscillations, round off noise in IIR digital filters	L58	T1,R1	1
	Computational output round off noise, methods to prevent over flow	L59	T1,R1	1
	Trade off between round off and overflow noise	L60	T1,R1	1
	Measurement of coefficient quantization effects through pole-zero movement	L61	T1,R1	1
	Dead band effects	L62	T1,R1	1
No. of classes required				**12**
Total No. of Classes				**52**

(8) SUGGESTED BOOKS:

TEXT BOOKS:

T1:-Digital signal processing, principles, algorithms and applications: Johnn G.Proakis, Dimitris G.Monalakis, Pearson Education/PHI 2007
T2:-Discrete Time Signal Processing –A.V.Oppenheim and R.W.Schaffer,PHI 2009
T3:-Fundamentals of Digital Signal Processing-Loney Ludeman,John Wiley, 2009

REFERENCES:

R1:-Digital Signal Processing –S.Salivahanan,A.Vallavaraj and C.Gnana Priya,TMH ,2009
R2:-Discrete Time Signal Processing-Fundamentals and Applications-Litan, Elsevier,2008
R3:-Fundamentals of Discrete Time Signal Processing using Matlab- Robertj.Schilling,Sandra L.Harris,Thomson ,2007
R4:-Digital signal processing a practical approachbyEmmanuel C. Ifeachor

(9) WEBSITES FOR SELF LEARNING RESOURCES:

1. NPTEL VIDEO LECTURES:
https://nptel.ac.in/courses/117/102/117102060/

2. COURSERA:
https://www.coursera.org/specializations/digital-signal-processing#howItWorks

3. MIT OPEN COURSEWARE:
http://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/

4. EDX:

https://www.edx.org/course/discrete-time-signal-processing-4

4. UDEMY:

https://www.udemy.com/course/signal-processing-dft-fft/

(10) QUESTION BANK:

QUESTION BANK-JNTUH-MODEL.rar

(11) CASE STUDY

Project 1:-

TITLE:-A Comparative Study of ECG Beats Variability Classification Based on Different Machine Learning Algorithms

Abstract:-

The electrocardiogram (ECG) signal is a method that uses electrodes to record cardiac rates along with sensing minute electrical fluctuations for each cardiac rate. The information is utilized to analyze abrupt cardiac function like arrhythmias and conduction disturbance. The paper proposes strategy classifying ECG signal using various technique. The preprocessing stage includes filtering of input signal via low pass, high pass including Butterworth filter in order to remove clamour of high frequency. From signal, the excess clamour is sliced by Butterworth filter. The peak points are detected by peak detection algorithm, and the signal features are extracted using statistical parameters. At last, extracted feature classification is done via GWO-MSVM, SVM, Adaboost, ANN and Naive Bayes classifier to classify the ECG signal database into normal or abnormal ECG signal. The experimental result indicates the precision of the GWO-MSVM, SVM, Adaboost, ANN and Naive Bayes classifier is 99.9%, 94%, 93%,87.57% and 85.28%. When compared with other classifier, it was determined that precision of GWO-MSVM classifier is high.

Project 2:-

TITLE:-Monophonic Pitch Recognition

Abstract:-

The purpose of this project is to create a system that automatically converts monophonic music into its MIDI equivalent. Automatic pitch recognition allows for numerous commercial applications, including automatic transcription and digital storage of live performances.

It is also desirable to be able to take an audio signal as an input and create a MIDI equivalent score because the MIDI information can be used to replace the original audio signal sounds with any sound the user would like. For example, if a piano composition is entered into the system, the resulting MIDI out could be used to trigger guitar samples.

The main deliverable for this project is a DSP evaluation board that takes a monophonic analog audio signal (ex. a recorder or someone's voice creating one pitch at a time), analyzes the signal for its fundamental frequency, and output s MIDI data that represents the pitch and timing information contained in the audio signal all in real time.

(12) ASSIGNMENT:

Assignment1 :(From 1 unit)

PART-A:

1. a) Discuss various Discrete time sequences and mention the importance of each sequence.
   b) Define an LTI system and derive the expression for the output response of an LTI system whose input sequence is x(n) and impulse function of the system is h(n).
2. a) Define Linearity, Time Invariant, Stable and Casual w.r.to a system.
   b) Check whether the system defined by the following difference equation satisfy the conditions mentioned above $y(n) = 2\,x(n)-4\,x(n-1) + 6n\,x(n-2) + y(n-1)$.
3. a) Prove that the recursive system described by the linear constant coefficient difference equation described by $y(n) = ay(n-1) + x(n)$ is liner and Time invariant.
   b) Determine whether the LTI recursive system described above is stable or not.
4. (a) What is Signal Processing and list the advantages, Limitations of Digital Signal Processing. List out some applications of it.
   (b) Discuss in brief about the classification of signals.
5. (a) Give the differences between analog and digital system.
   (b) Give the block diagram of Analog Signal Processing and compare with Digital signal Processing system and list out the applications of each.
6. (a) Define the operations of a signal - Time scaling, Amplitude Scaling and folding.
   (b) What is an LTI system? Show that an LTI system combined with time scaling property may result in an Time-variant system.

PART-B:

1. a) Define transfer function of Digital System in general, and the relation of it with input/output difference equation.
   b) Obtain the cascade structure of 1st order cananic form of the following system.
   $y(n) – 3\,y(n-1) – 4\,y(n-2) = x(n) + 2x(n-1)$
2. a) Discuss about cascade and parallel form realization structures of IIR systems.
   b) Obtain the parallel and cascade realization structures for the system function given by $H(Z) = (1+0.5Z^{-1}) / [(1+0.5Z^{-1})(1+0.5Z^{-1}+0.25Z^{-2})]$.
3. a) Define System function and bring out its relationship with difference equation

b) Determine the system function and also find its poles and zeros if y(n)+3y(n-1)+1/8y(n-2) = x(n)+x(n-1).

4. Obtain all the possible realization structures of the following transfer function.

H(Z) = 1 □ bcos_Z□1=(1 + aZ□1)(1 □ 2bcos_Z□1+b2Z□2):

5.a) Discuss Cascade and Parallel form realization structures of IIR systems.

b) Obtain the parallel and cascade realization structures for the system function given by H(Z) = $(1+\frac{1}{4}Z^{-1}) / (1+\frac{1}{2}Z^{-1}) (1+\frac{1}{2}Z^{-1}+\frac{1}{4}Z^{-2})$.

6. (a) Determine the impulse response h(n) for the system described by the second order difference equation

y(n)-4y(n-1)+4y(n-2) = x(n-1).

(b) An LTI system is described by the equation y(n) = x(n)+0.8x(n-1)+0.7x(n-2)- 0.45y(n-2). Determine the transfer function of the system. Sketch its poles and zeros on the Z-plane.

7. (a) Define Phase delay and group delay.

(b) The following transfer function characterizes an FIR filter (M=11). Determine the magnitude response and show that the phase and group delays are constant.

8. (a) Define Z- Transform. State any four properties of Z- transform.

(b) A system has an impulse response h(n) = {1,2,3} and output response y(n)= {1, 1, 2,-1, 3}. Determine the input sequence.

Assignment2 :(From 2 unit)

PART-A:

1. a) Explain the Frequency response of discrete systems and hence the importance of it.

b) Define DFT and obtain the relation between z- transform and DFS

2.a) Define DFT and IDFT.

b) Compute 8-point DFT of given sequence x(n) = {1,1,1,1,0,0,0,0} and also compute IDFT for the result obtained with DFT and verify whether the original sequence is obtained or not.

3. a) Discuss the computational complexity of computing N-Point DFT.

b) Perform Linear convolution of the two given sequences x(n) = {3,1,3} and h(n) = {2,1} using DFT and IDFT.

4. (a) Determine the relationship between DFT and Fourier transform of an aperiodic sequence.

(b) Perform Linear convolution of the two sequences x(n) = {1, 3, 1, -2, -3, 4,5, 6} and h(n) = {2, -1, 1} using over-lap save method and verify the result using Over-lap add method.

5. (a) Compute DFT for the given sequence x(n) = {1, 3, 3, 4}.

(b) Compute linear convolution of two given sequences x(n) ={1, 1, 3}and h(n) = {2, 4}.

6. (a) Define DFT and IDFT. Prove Circular convolution, Circular correlation and Time reversal properties of DFT.

(b) Find the IDFT of the sequence X(K) ={1, 2-3j, 4, 2+3j}.

7. a) State the properties of DFT of a delayed sequence, Time reversed sequence, circular convolution, Circular frequency shift and circular time shift.

b) Determine the response of the system whose input x(n) and impulse response h(n) are given by x(n) = {1,2} and h(n) = {1,2,} using DFT and IDFT.

PART-B:

1. a) What is FFT? Explain the advantages of FFT over DFT. Obtain the signal flow graph of FFT algorithm and explain its operation.

b) Obtain the DFT of sequence x(n) : [1,2,3,4,4,3,2,1] using FFT algorithm.

2. a) Compare the computational complexity of DFT and FFT.

b) An 8 point sequence is given by x(n) = {1,2,1,2,1,2,1,2}. Compute 8 point DFT of x(n) using Radix-2 decimation in time FFT

3. a) What is bit reversed technique and explain it with an example?

b) What is DIT algorithm? Give the mathematical analysis of DIT algorithm using Radix-2 In-place algorithm

4.a) What is In-place algorithm and what is the advantage of this algorithm?

b) Compute 8-point DFT of the given sequence x(n) = {1,2,1,2,1,2,1,2} using DIF FFT algorithm.

5. What is DIF algorithm? Give the mathematical analysis of DIF algorithm using Radix-2 In-place algorithm.

6. (a) Compare DIT and DIF FFT algorithms.

(b) Develop the signal ow graph in computing 16-point FFT using DIT-FFT algorithm.

7. (a) Give the Basic buttery structures of computing DFT using DIT and DIF algorithm.

(b) Compute the IFFT for the sequence X(K) ={0, 1, 2, 3, 0, 0, 0, 0}, using DIT algorithm.

8.Develop a radix -2 DIF / FFT algorithm for evaluating the DFT for N=8 and hence determine the 8-point DFT of the sequence x(n) = { 0, 1, 0, 1, 0, 1, 0, 1}.

Assignment3 :(From 3unit)

PART-A

1. a) Explain clearly about the design of IIR filters from analog prototypes and hence bring out the constraints.

b) Design a digital Low pass filter, with following specifications. Using Butterworth approximation and Bilinear Transformation.

Pass band ripple ≤ 1 dB; Pass band edge = 4 kHz,

Stop band AHn≥ 40d B; Stop band edge = 6 kHz

Sampling rate = 24 kHz. Assume suitable data.

2. a) Explain how aliasing effect occurs in designing of IIR filters using impulse invariant technique.

b) Compute the poles of an analog Butterworth filter transfer function that satisfies the constraints

$0.707 \leq |H(j\Omega)| \leq 1$; $0 \leq \Omega \leq 2$

$|H(j\Omega)| \leq 0.1$; $\Omega \geq 4$ and determine Ha(s) and hence obtain H(z) using Bilinear transformation.

3. a) Compare Impulse invariant and Bilinear transformation techniques.

b) Discuss the procedure of converting an IIR analog filter into digital filter using bilinear transformation. List out its merits and demerits.

4. (a) In a speech recording system with a sampling frequency of 10,000 Hz, the speech is corrupted by random noise. To remove the random noise while preserving speech information, the following specifications are given.

Speech frequency range : 0 - 3000 KHz.

Stop band range : 4,000 - 5,000 KHz.

Passband ripple : 3 dB

Stopband attenuation : 25 dB.

Determine the _lter order and transfer function using butterworth IIR filter.

(b) How Chebyshev filter approximation is superior than butterworth filter approximation.

5. (a) What is Bilinear transformation and sketch the mapping of S-plane into Z-plane in bilinear transformation.
(b) Discuss the problems encountered in design of digital filter using Impulse inVariant and bilinear transformation techniques.
6. (a) Compare Butterworth and Chebyshev approximation techniques of filter designing.
(b) Design a Digital Butterworth LPF using Bilinear transformation technique for the following specifications
0.707 H(w)j _ 1; 0 _ w _ 0:2_jH(w)j _ 0:08; 0:4_ _ w _ _
7. (a) Discuss in detail the procedure of designing an analog filter using Butterworth approximation technique.
(b) Explain how to convert an analog filter transfer function into digital filter transfer function using Bilinear transformation.

Assignment4 :(From 4 unit)
1. a) Discuss about the importance of windowing technique in the design of FIR filters and compare Barlett and Hamming windows w.r.t. Rectangular windows.
b) What is linear phase? What is the condition for linear phase systems in FIR systems? Explain.
2. Design an FIR Digital high pass filter using Rectangular window whose cut off frequency is 3 rad/s and length of window N=9. Draw and comment on magnitude response characteristics of w.r.t side lobe levels and main lobe width. Realize the same using direct form structure.
3.a) Define an IIR filter and bring out the constraints to be maintained in conversion of an analog filter into digital filter.
b) Discuss the procedure of converting an IIR analog filter into digital filter using impulse invariant transformation.
4.a) Explain briefly the frequency response of LTI systems.
b) Determine the frequency response of the second order system given by the difference equation
$y(n) = 2r\cos\omega_o y(n-1) - r^2 y(n-2)+x(n) - r\cos\omega_o x(n-1)$.
5.(a) What are the desirable characteristics of windowing function to be satisfied in filter design.
(b) Design an FIR Digital Low pass filter using Blackman-Tukey window whose cutoff freq is 1.2 rad/s and length of window N=5.
6. (a) FIR filters are always stable and have linear phase characteristics. Justify.
(b) Design an FIR Digital Band stop filter using rectangular window whose upper and lower cut off frequencies are 4 & 5 rad/s and length of window N=9. Realize the filter using linear phase Realization structure.
7. (a) Compare FIR and IIR filters.
(b) Justify the statement that FIR filters can have linear phase characteristics.
8. (a) Convert the single pole low pass Butterworth filter with system function H(Z) = 0.245(1 + Z□1) /(1 - 0.509 Z□1) into a band pass filter with upper and lower cut off frequencies !u and !1. The low pass filter has 3dB band width !p =0.2 _.
(b) State advantages of IIR filters over FIR filters.

Assignment5 :(From 5 unit)
PART- A:
1. a) What is Multirate processing? Discuss the necessity for it.
b) Explain in detail about the Implementation of interpolation & decimation processes and hence discuss about optimum filter requirements.

2.a) Explain the necessity of Multirate signal processing and hence define Decimation and Interpolation.

b) Discuss the sampling rate conversion by a factor I/D.

3.a) What are Multirate Systems? Discuss their importance in real time processing of signals.

b) Explain the process of Interpolation by a factor-I and also discuss how the images are eliminated with a neat block diagram.

4.a) Discuss the various cases of frequency responses of FIR filters.

b) Compare various windowing techniques in FIR filter design w.r.t beam width and side lobes.

5. (a) Discuss the process of Decimation by a factor D and hence explain how the aliasing effect can be avoided.

(b) Explain the process of performing subband coding for speech signals. [7+8]

6. (a) Design a poly phase filter structure for a sequence x(n) = { x(0), x(1), x(2),x(3) g} Interpolated by a factor 3 and consider the filter length N=9.(b) Explain the process of performing subband coding for speech signals.

7. (a) Discuss the process of Decimation by a factor D with a neat block diagram.

(b) Plot the signals and their corresponding spectra for rational sampling rate conversion by a) I/D = 5/3 and

b) I/D = 3/5. Assume that the spectra of input signal x(n) occupies the entire range -_ _ !x _ _.

PART-B:

1. (a) Discuss the effects due to finite word length in Direct form - I and II structures.

(b) Discuss the effect of quantization of coefficients in FIR filters.

2. (a) Discuss finite word length effects of implementation of FFT algorithm.

(b) What is scaling? Discuss how to reduce finite word length effects using scaling.

3. (a) Discuss the effect of ADC Quantization noise on Signal Quality.

(b) Discuss finite word length effects of implementation of FFT algorithm.

4.What are Limit Cycles? Discuss various types of Limit Cycles in brief.

SLIP TESTS:

Slip tests are conducted in the class rooms.
8 slip tests are conducted per course.
3 questions are given for each slip test.

Instructions:

Slip test should be in written documents with the following requirements.

1) Cover page with name, roll number, course name and course section.

2) A page with questions.3) Solutions/Explanations.

Slip Test1 :(From unit 1)

1. a) Discuss various Discrete time sequences and mention the importance of each sequence.

b) Define an LTI system and derive the expression for the output response of an LTI system whose input sequence is x(n) and impulse function of the system is h(n).

2. a) Define Linearity, Time Invariant, Stable and Casual w.r.to a system.

b) Check whether the system defined by the following difference equation satisfy the conditions mentioned above y(n) = 2 x(n)-4 x(n-1) + 6n x(n-2) +y(n-1).

3. a) Prove that the recursive system described by the linear constant coefficient difference equation described by y(n) = ay(n-1) + x(n) is liner and Time invariant.

b) Determine whether the LTI recursive system described above is stable or not.

4.a) Discuss Cascade and Parallel form realization structures of IIR systems.

b) Obtain the parallel and cascade realization structures for the system function given by $H(Z) = (1+¼Z^{-1}) / (1+½Z^{-1}) (1+½Z^{-1}+¼Z^{-2})$.

5.(a) Determine the impulse response h(n) for the system described by the second order difference equation y(n)-4y(n-1)+4y(n-2) = x(n-1).

(b) An LTI system is described by the equation y(n) = x(n)+0.8x(n-1)+0.7x(n-2)- 0.45y(n-2). Determine the transfer function of the system. Sketch its poles and zeros on the Z-plane.

6. a) Define System function and bring out its relationship with difference equation

b) Determine the system function and also find its poles and zeros if y(n)+3y(n-1)+1/8y(n-2) = x(n)+x(n-1).

Slip Test2 :(From unit 2)

1.a) Define DFT and IDFT.

b) Compute 8-point DFT of given sequence x(n) = {1,2,3,4,4,3,2,1} and also compute IDFT for the result obtained with DFT and verify whether the original sequence is obtained or not.

2. a) Discuss the computational complexity of computing N-Point DFT.

b) Perform Linear convolution of the two given sequences x(n) = {1,2,3} and h(n) = {2,1} using DFT and IDFT.

3. (a) Determine the relationship between DFT and Fourier transform of an aperiodic sequence.

(b) Perform Linear convolution of the two sequences x(n) = {12, 3, -1, -2, -3, 4,5, 6} and h(n) = {2, 1, -1} using over-lap save method and verify the result using Over-lap add method.

4. a) What is FFT? Explain the advantages of FFT over DFT. Obtain the signal flow graph of FFT algorithm and explain its operation.

b) Obtain the DFT of sequence x(n) : [1,2,3,4,4,3,2,1] using FFT algorithm.

5. a) Compare the computational complexity of DFT and FFT.

b) An 8 point sequence is given by x(n) = {1,2,1,2,1,2,1,2}. Compute 8 point DFT of x(n) using Radix-2 decimation in time FFT

6. (a) Compare DIT and DIF FFT algorithms.

(b) Develop the signal ow graph in computing 16-point FFT using DIT-FFT algorithm.

Slip Test3 :(From unit 3)

1. a) Explain clearly about the design of IIR filters from analog prototypes and hence bring out the constraints.

b) Design a digital Low pass filter, with following specifications. Using Butterworth approximation and Bilinear Transformation.

Pass band ripple ≤ 1 dB; Pass band edge = 4 kHz,

Stop band AHn≥ 40d B; Stop band edge = 6 kHz

Sampling rate = 24 kHz. Assume suitable data.

2. a) Explain how aliasing effect occurs in designing of IIR filters using impulse invariant technique.

b) Compute the poles of an analog Butterworth filter transfer function that satisfies the constraints $0.707 \leq |H(j\Omega)| \leq 1$; $0 \leq \Omega \leq 2$

$|H(j\Omega)| \leq 0.1$; $\Omega \geq 4$ and determine Ha(s) and hence obtain H(z) using Bilinear transformation.

3. a) Compare Impulse invariant and Bilinear transformation techniques.

b) Discuss the procedure of converting an IIR analog filter into digital filter using bilinear transformation.List out its merits and demerits.

Slip Test4 :(From unit 4)

1. a) Discuss about the importance of windowing technique in the design of FIR filters and compare Barlett and Hamming windows w.r.t. Rectangular windows.

b) What is linear phase? What is the condition for linear phase systems in FIR systems? Explain.

2. Design an FIR Digital high pass filter using Rectangular window whose cut off frequency is 3 rad/s and length of window N=9. Draw and comment on magnitude response characteristics of w.r.t side lobe levels and main lobe width. Realize the same using direct form structure.

3.a) Define an IIR filter and bring out the constraints to be maintained in conversion of an analog filter into digital filter.

b) Discuss the procedure of converting an IIR analog filter into digital filter using impulse invariant transformation.

Slip Test5 :(From unit 5)

1. a) What is Multirate processing? Discuss the necessity for it.

b) Explain in detail about the Implementation of interpolation & decimation processes and hence discuss about optimum filter requirements.

2.a) Explain the necessity of Multirate signal processing and hence define Decimation and Interpolation.

b) Discuss the sampling rate conversion by a factor I/D.

3. (a) Design a poly phase filter structure for a sequence x(n) = { x(0), x(1), x(2),x(3) g} Interpolated by a factor 3 and consider the filter length N=9.

(b) Explain the process of performing subband coding for speech signals

4. (a) Discuss the effects due to finite word length in Direct form - I and II structures.

(b) Discuss the effect of quantization of coefficients in FIR filters.

5. (a) Discuss finite word length effects of implementation of FFT algorithm.

(b) What is scaling? Discuss how to reduce finite word length effects using scaling.

6. (a) Discuss the effect of ADC Quantization noise on Signal Quality.

(b)What are Limit Cycles? Discuss various types of Limit Cycles in brief

ASSESSMENT PLAN FOR ACTIONS:

Assessment plan for Assignments:

Content	Weightage
Problems	60%
Descriptive	30%
Analytical/ Reasoning	10%

Assessment plan for Slip Test:

Content	Weightage

Analyzing the problems	60%
Theoretical questions	30%
Reasoning	10%

13) List of topics for student's seminars:

- Discrete Wavelet Transform
- Audio Signal Processing
- Speech Compression And Transmission In Digital Mobile Phones
- Orthogonal Transforms For Digital Signal Processing
- Room Correction Of Sound In Hi-Fi And Sound Reinforcement Applications
- Seismic Data Processing, Analysis
- Processing Of Digital Photographs
- Complex Digital Signal Processing In Telecommunications
- A DSP Practical Application: Working On ECG Signal
- Complex Digital Filter Designs For Audio Processing In Doppler Ultrasound System
- Most Efficient Digital Filter Structures: The Potential Of Halfband Filters In Digital Signal Processing
- Applications Of Interval-Based Simulations To The Analysis And Design Of Digital LTI Systems
- Digital Camera Identification Based On Original Images.

(14) STEP/COURSE MATERIAL:

DSP-TOTAL.rar

(15) EXPERT LECTURE WITH TOPICS & SCHEDULES

S.NO	SUBJECT	TOPIC	YEAR	RESOURCE PERSON
1	DSP-I	DFS,DFT,FFT	III-II	IETE
2	DSP-II	Design of FIR &IIR Filters	III-II	OTHERS

ACADEMIC PLANNER

Subject : ELECTROMAGNETIC FIELDS AND WAVES

S.NO	CONTENT
(1)	- Objectives & Outcomes as per NBA
(2)	- Scope
(3)	- Prerequisites
(4)	- Syllabus (JNTUH / GATE)
(5)	- Subject (lesson) Plan
(6)	- Suggested Books (Text / Ref)
(7)	- Question Bank with Ans. (JNTU/GATE)
(8)	- E-Resources (CMREC Repositories)
(9)	- Expert Details (Guest Lect. / Seminars)
l)	-Assignment / Innovative Assignment Question
m)	–Important Question sets on each unit
(12)	- List of topics for student's seminars

1.**Objectives & Outcomes**

Objectives

This is structured foundation course, dealing with concepts, formuations and applications of Electromagnetic Theory and transmission Lines, and is the basic primer for all electronic communication engineering subjects. The main objectives of the course are

1. To learn Basic Laws, Concepts and Proofs related to electrostatic fields and magnetostatic fields, and apply them to solve physics and engineering problems
2. To distinguish between static and timevarying fields and understand the significane and utility of maxwells equations and boundary conditions and gain ability to provide solutions to communication engineering problem
3. To analyze the charecteristics of uniform plane waves determine their propagation parameters and estimate the same for dielectric and dissipative media.
4. To conceptually understand the UPW polarization features and Poynting theorem and apply them for practical problems
5. To conceptually understand the waveguides and to determine the characteristics of rectangular waveguides, microstrip lines

Outcomes

Having gone through this foundation course, the students would be able to

1. Distinguish between the static and time varying fields, establish the corresponding sets of Maxwell's equations and boundary conditions, and use them for solving engineering problems
2. Analyze the wave equations for good conductors and good dielectrics, and evaluate the UPW characteristics for several practical media of interest.
3. Establish the proof and estimate the polarization features, reflection and transmission coefficients for UPW propagation, distinguish between Brewster and critical angles and acquire knowledge of their applications.
4. To analyze completely the rectangular waveguides, their mode characteristics, and design waveguides for solving practical problems.

2. Scope:

The scope of the subject is to provide the thorough knowledge of the electric and magnetic fields (static and time varying fields) and characteristics.

3. Prerequisites

This course assumes that students have had an introduction to vectors and vector calculus and vector algebra basic knowledge of scalar and vector, electrical parameters is required.

4. Syllabus (JNTUH / GATE)

UNIT – I

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

UNIT – II

Magneto statics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Illustrative Problems.

UNIT – III

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface : Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems .

UNIT – IV

EM Wave Characteristics - I: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Illustrative Problems.

EM Wave Characteristics – II: Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem – Applications, Illustrative Problems.

UNIT – IV

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

5. SUBJECT (LESSON) PLAN

S.NO	Topic (JNTUH syllabus)	Sub-Topic	NO. OF PERIODS	Text Books Reffered	Method of Teaching
1	INTRODUCTION	Introduction, coordinate systems	**1**	**T1**	**M1, M2**
2		Vector calculus	**1**	**T1,R3**	**M1, M2**
3		Differential vector component	**1**	**T1,R1**	**M1, M2**
4		Lapalcian, poission's euations	**1**	**T1,R3**	**M1, M2**
5	UNIT 1	Coulomb's Law	**1**	**T1,R1**	**M1, M2**
6		Electric Field Intensity – Fields due to Different Charge Distributions	**1**	**T1,R3**	**M1, M2**
7		Electric Flux Density, Gauss Law and Applications	**2**	**T1,R1**	**M1, M2**

8		Electric Potential,	**1**	**T1,R3**	**M1, M2**
9		Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields	**1**	**T2,R1**	**M1, M2**
10		Energy Density	**1**	**T1,R3**	**M1, M2**
11		Convection and Conduction Currents	**1**	**T1,R2**	**M1, M2**
12		Dielectric Constant, Isotropic and Homogeneous Dielectrics	**1**	**T1,R1**	**M1, M2**
13		Continuity Equation, Relaxation Time	**1**	**T1,R1**	**M1, M2**
14		Poisson's and Laplace's Equations; Capacitance – Parallel Plate	**1**	**T1,R1**	**M1, M2**
15		Coaxial, Spherical Capacitors	**1**	**T1,R1**	**M1, M2**
16		Illustrative Problems	**1**	**T1,R1**	**M1, M2**

17	UNIT 2	Biot-Savart’s Law	**1**	**T1**	**M1, M2**
18		Ampere’s Circuital Law and Applications	**2**	**T1**	**M1, M2**
19		Magnetic Flux Density, Maxwell’s Two Equations for Magnetostatic Fields	**1**	**T2,R3**	**M1, M2**
20		Magnetic Scalar and Vector Potentials	**1**	**T1,R3**	**M1, M2**
21		Forces due to Magnetic Fields, Ampere’s Force Law	**1**	**T2**	**M1, M2**
22		Faraday’s Law and Transformer EMF	**1**	**T1**	**M1, M2**
23		Inconsistency of Ampere’s Law and Displacement Current Density	**2**	**T1,T2,R3**	**M1, M2**
24	UNIT-3	Maxwell’s Equations in Different Final Forms and Word Statements	**2**	**T1,R1**	**M1, M2**
25		Conditions at a Boundary Surface : Dielectric-Dielectric	**2**	**T1,R1**	**M1, M2**

26		Dielectric-Conductor Interfaces, Illustrative Problems	**1**	**T1,R1**	**M1, M2**
27	UNIT 4	Wave Equations for Conducting and Perfect Dielectric Media	**1**	**T2,R1**	**M1, M2**
28		Uniform Plane Waves – Definition, All Relations Between E & H	**2**	**T1**	**M1, M2**
29		Sinusoidal Variations	**1**	**T2**	**M1, M2**
30		Wave Propagation in Lossless and Conducting Media	**2**	**T2,R1**	**M1, M2**
31		Conductors & Dielectrics – Characterization	**1**	**T2,R1**	**M1, M2**
32		Wave Propagation in Good Conductors and Good Dielectrics	**1**	**T1,R1**	**M1, M2**
33		Polarization	**1**	**T1,R1**	**M1, M2**
34		Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics	**2**	**T2,R1**	**M1, M2**

35		Brewster Angle, Critical Angle and Total Internal Reflection	**1**	**T1,R1**	**M1, M2**
36		Surface Impedance, Poynting Vector and Poynting Theorem – Applications	**2**	**T2,R1**	**M1, M2**
37		Illustrative Problems	**1**	**T1,R3**	**M1, M2**
38	UNIT 5	Electromagnetic Spectrum and Bands	**1**	**T2,R2**	**M1, M2**
39		Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates	**1**	**T1,R2**	**M1, M2**
40		TE/TM mode analysis Expressions for Fields, Characteristic Equation and Cut-off Frequencies	**1**	**T1,R2**	**M1, M2**
41		Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section	**2**	**T1,R2,R4**	**M1, M2**
42		Phase and Group Velocities, Wavelengths and Impedance Relations	**1**	**T1,R2**	**M1, M2**
43		Equation of Power Transmission, Impossibility of TEM Mode	**1**	**T2,R2**	**M1, M2**

44		Microstrip Lines – Zo Relations, Effective Dielectric Constant.	**1**	**T1,R2**	**M1, M2**

Innovative Teaching Methods:

M1 : Green Board

M2 : ICT Methods (PPT /E-Resources / NPTEL)

M3 : Think-pair-share

M4 : Group Learning

M5 : Mind Mapping

M6 : Mnemonics

6. Suggested Books (Text / Ref)

TEXT BOOKS:

1. Principles of Electromagnetics – Matthew N.O. sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Aisan Edition, 2015.
2. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 8th Ed., McGrawHill,2014
3. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, 2nd Ed. 2000, PHI.

REFERENCE BOOKS:

1. Engineering Electromagnetics – Nathan Ida, 2nd Ed., 2005, Springer (India) Pvt. Ltd., New Delhi.
2. Networks, Lines and Fields – John D. Ryder, 2nd Ed., 1999, PHI.
3. Engineering Electromagnetics – William H. Hayt Jr. and J hn A. Buck, 7th Ed., 2006, MC GRAW HILL EDUCATION

7. Question Bank with Ans. (JNTU/GATE)

UNIT 1 – ELECTROSTATICS I

1. State stokes theorem.

The line integral of a vector around a closed path is equal to the surface integral of the normal component of its curl over any surface bounded by the path

$\int H.dl = \int\int (\Delta x H)ds$

Where, H=Magnetic field intensity

2. State the condition for the vector F to be solenoidal.

$\Delta.F = 0$
Where, F=A i + B i + C i

3. State the condition for the vector F to be irrotational.

$\Delta x F = 0$
Where, F=A i + B i + C i

4. Give the relationship between potential gradiant and electric field.

$E = -\Delta V$
Where, E=Electric Field Intensity
V=Electric Potential

5. What is the physical significance of div D ?
The divergence of a vector flux density is electric flux per unit volume leaving a small volume. This is equal to the volume charge density.

6. What are the sources of electric field and magnetic field?
Stationary charges produce electric field that are constant in time, hence the term electrostatics. Moving charges produce magnetic fields hence the term magneto statics.

7. State Divergence Theorem.
The integral of the divergence of a vector over a volume v is equal to the surface integral of the normal component of the vector over the surface bounded by the volume.
$\iint \Delta.F\, ds = \iiint F\, dv$
Where, F=A i + B i + C i

8. Define divergence.
The divergence of a vector F at any point is defined as the limit of its surface integral per unit volume as the volume enclosed by the surface around the point shrinks to zero.

9. State coulombs law.
Coulombs law states that the force (F) between any two point charges (Q1 and Q2) is directly proportional to the product of their magnitudes and inversely proportional to the square of the distance ® between them. It is directed along the line joining the two charges.

$$F= (Q1Q2) / (4\Pi\varepsilon r^2)\ dr$$

10. State Gauss law for electric fields

The total electric flux passing through any closed surface is equal to the total charge enclosed by that surface.

11. Define electric flux.

The lines of electric force is known as electric flux.

12. Define electric flux density.

Electric flux density is defined as electric flux per unit area.

Electric flux density=ϕ/A

13.Define electric field intensity.

Electric field intensity is defined as the electric force per unit positive charge. E =F/ Q
=$Q/4\Pi\varepsilon r^2$ V/m

14. Name few applications of Gauss law in electrostatics.

Gauss law is applied to find the electric field intensity from a closed surface. Ex: Electric field can be determined for shell, two concentric shell or cylinders etc.

15. What is electrostatic force?

The force between any two particles due to existing charges is known as electrostatic force, repulsive for like and attractive for unlike.

16. What are dielectrics?

Dielectrics are materials that may not conduct electricity through it but on applying electric field induced charges are produced on its faces .The valence electron in atoms of a dielectric are tightly bound to their nucleus.

17. What is a capacitor?

A capacitor is an electrical device composed of two conductors which are separated through a dielectric medium and which can store equal and opposite charges ,independent of whether other conductors in the system are charged or not.

18. Define dielectric strength.

The dielectric strength of a dielectric is defined as the maximum value of electric field that can b applied to the dielectric without its electric breakdown.

19. What meaning would you give to the capacitance of a single conductor?

A single conductor also possess capacitance. It is a capacitor whose one plate is at infinity.

20.Why water has much greater dielectric constant than mica.?

Water has a much greater dielectric constant than mica .because water has a permanent dipole moment, while mica does not have.

21. What is a point charge?

Point charge is one whose maximum dimension is very small in comparison with any other length.

22. Define linear charge density($\rho 1$).

It is defined as the charge (Q) per unit length (L).

$\rho 1 = Q/L$

23. Define potential difference.

Potential difference is defined as the work done in moving a unit positive charge from one point to another point in an electric field.

24. Define potential.

Potential at any point is defined as the work done in moving a unit positive charge from infinity to that point in an electric field.

$V = Q / 4\Pi\varepsilon r^2$

Where, V=Electric Potential

Q=Charge

ε= Relative permittivity

r=Distance between charge

1. **Give the relation between electric field intensity (E) and electric flux density**

   (D). $D = \varepsilon E$ C/m2

2. **Write the expression for energy density in electrostatic field.**

$W = 1 / 2\ \varepsilon E^2$

Where, V=Electric Potential

W=Energy Density

3. **Write the boundary conditions at the interface between two perfect dielectrics.**

   a. The tangential component of electric field is continuous i.e) Et1=Et2
   b. The normal component of electric flux density is continuous i.e) Dn1=Dn2

4. **Write down the expression for capacitance between two parallel plates.**

$C = \varepsilon A / d$

Where, C=Capacitance

A=Area

d= Distance between charge

5. **State amperes circuital law.**

Magnetic field intensity around a closed path is equal to the current enclosed by the path.

H.dl=I

Where, H=Magnetic field intensity

I= Current

PART B QUESTIONS

1. Given that potential $V=10\sin\theta\cos\Phi/r2$ find the electric flux density D at $(2,\pi/2,0)$
2. Derive an expression for the electric field due to a straight and infinite uniformly charged wire of length 'L' meters and with a charge density of $+\lambda$ c/m at a point P which lies along the perpendicular bisector of wire.

3. Explain poissons and lapace's equations.
4. A uniform line charge ρL =25Nc/m lies on the x=3m and y=4m in free space .Find the electric field intensity at a point (2,3,15)m.
5. Obtain the expression for the energy stored in a capacitor.
6. Drive an expression for energy stored and energy density in an electrostatic field.
7. Derive an expression for the capacitance of two wire transmission line.
8 Derive an expression for capacitance of concentric spheres.
9. Derive an expression for capacitance of co-axial cable.
10 .Explain and derive the polarization of a dielectric materials.

1. List out the properties of dielectric materials.
2. Derive an expression for series and parallel plate capacitor.
3. The electric field in a spherical co-ordinate is given by E=rρr/5ε. Show that closed ∫E.dS=∫(▼.E)Dv.
4. State and proof divergence theorem and strokes theorem.
5. Check validity of the divergence theorem considering the field D=2xy ax +x2ay c/m2 and the rectangular parallelepiped formed by the planes x=0,x=1,y=0,y=2 & z=0,z=3.
6. A vector field D=[5r2/4]Ir is given in spherical co-ordinates. Evaluate both sides of divergence theorem for the volume enclosed between r=1&r=2.
7. Given A= 2r cosΦ+Riφ in cylindrical co-ordinates for the contour x=0to1 y=0to1 , verify stoke's theorem.
8. Explain three co-ordinate system.
9. State and proof gauss law .and explain applications of gauss law.

UNIT 2 –MAGNETOSTATICS

1.State Biot –Savarts law.

It states that the magnetic flux density at any point due to current element is proportional to the current element and sine of the angle between the elemental length and inversely proportional to the square of the distance between them

$dB=\mu 0\ Idl\ \sin\theta / 4\Pi\varepsilon r^2$

Where, B=Magnetic field density
I= Current
r= Distance between charge
ε= Relative permittivity

2. What are the significant physical differences between Poisson 's and laplace's equations.

Poisson's and laplace's equations are useful for determining the electrostatic potential V in regions whose boundaries are known.
When the region of interest contains charges poissons equation can be used to find the potential.
When the region is free from charge laplace equation is used to find the potential.

3. Give the expression for electric field intensity due to a single shell of charge $E = Q / 4\Pi\varepsilon r^2$

Where, E=Electric field indensity
r= Distance between charge
ε= Relative permittivity

4. Give the expression for potential between two spherical shells

$V = 1/ 4\Pi (Q1/a – Q2/b)$

5. Define electric dipole.
lectric dipole is nothing but two equal and opposite point charges separated by a finite distance.

6. How is electric energy stored in a capacitor?
In a capacitor, the work done in charging a capacitor is stored in the form of electric energy.

7. Define current density.
Current density is defined as the current per unit area.
J= I/A Amp/m2

8. What is meant by displacement current?
Displacement current is nothing but the current flowing through capacitor. J= D / t

9.State point form of ohms law.
Point form of ohms law states that the field strength within a conductor is proportional to the current density.
$J=\sigma E$

10. Define surface charge density.
It is defined as the charge per surface area.
$\rho S=Q/S$

11. Define magnetic vector potential.
It is defined as that quantity whose curl gives the magnetic flux density.

12. Write down the expression for magnetic field at the centre of the circular coil.

H = I/2A.
Where, H=Magnetic Field Intensity
I=Current
A=Area

13. Give the relation between magnetic flux density and magnetic field intensity.

$B =\mu H$
Where, H=Magnetic Field Intensity
B=Magnetic Field Density

14. Write down the magnetic boundary conditions.

1. The normal components of flux density B is continuous across the boundary.
2. The tangential component of field intensity is continuous across the boundary.

15. Give the force(F) on a current element (dl).

$dF = BIdl\sin\theta$
Where, B=Magnetic Field Density
I=Current

16. Define magnetic moment.

Magnetic moment(m) is defined as the maximum torque (T) per magnetic induction of flux density (B).
$m=T/B$

17. State Gauss law for magnetic field.

The total magnetic flux passing through any closed surface is equal to zero.
$B.ds = 0$
Where, B=Magnetic Field Density

18. Define magnetic field strength.

The magnetic field strength (H) is a vector having the same direction as magnetic flux density (B).
$H=B/\mu$

19. Give the formula to find the force between two parallel current carrying conductors.

$F=\mu I1.I2 / 2\Pi R$
Where, F=Force I=Current
R=Distance between charge

20. Give the expression for torque experienced by a current carrying loop situated in a magnetic field.

$T = IAB\sin\theta$
Where, T=Torque
I=Current
A=Area
B=Magnetic Field Density

21. What is lorentz force?

Lorentz force is the force experienced by the test charge .It is maximum if the direction of movement of charge is perpendicular to the orientation of field lines.

22.Explain the conservative property of electric field.

The work done in moving a point charge around a closed path in a electric field is zero. Such a field is said to be conservative.

$$E.dl = 0$$

23. Write the expression for field intensity due to a toroid carrying a filamentary current I.

$H=NI / 2\Pi R$

Where,

H= Magnetic Field Intensity
N=Number of Turns
I=Current
R=Distance between charges

24. What are equipotential surfaces?

An equipotential surface is a surface in which the potential energy at every point is of the same vale.

19. Define loss tangent.

Loss tangent is the ratio of the magnitude of conduction current density to displacement current density of the medium.

20. Define reflection coefficients.

Reflection coefficient is defined as the ratio of the magnitude of the reflected field to that of the incident field.

21. Define transmission coefficients.

Transmission coefficient is defined as the ratio of the magnitude of the transmitted field to that of incident field.

6. What will happen when the wave is incident obliquely over dielectric – dielectric boundary?

When a plane wave is incident obliquely on the surface of a perfect dielectric part of the energy is transmitted and part of it is reflected .But in this case the transmitted wave will be refracted, that is the direction of propagation is altered.

7. What is the expression for energy stored in a magnetic field?

W = ½ LI2

24. What is energy density in magnetic field?

W = ½

μH2

25. Distinguish between solenoid and toroid.

Solenoid is a cylindrically shaped coil consisting of a large number of closely spaced turns of insulated wire wound usually on a non magnetic frame. If a long slender solenoid is bent into the form of a ring and there by closed on itself it becomes a toroid.

PART B QUESTIONS

1. Derive the expressions for magnetic field intensity due to finite and infinite line.
2. Derive the expressions for magnetic flux intensity due to solenoid of the coil.
3. Derive the expressions for magnetic field intensity due to toroidal coil and circular coil.
4. Derive an expression for energy stored and energy density in magnetic field.
5. Derive an expression for self inductance of two wire transmission line.
6. Derive an expression for force between two current carrying conductors.
7. Derive an expression for co-efficient of coupling.
8. Explain Magnetic materials and scalar and vector magnetic potentials.
9. Derive the expressions for boundary conditions in magnetic fields.
10. Derive the expression for torque developed in a rectangular closed circuit carrying current I a uniform field.

UNIT 3 – MAXWELL'S EQUATIONS (TIME VARYING FIELDS)

1. State Maxwells fourth equation.

The net magnetic flux emerging through any closed surface is zero.

2. State Maxwells Third equation

The total electric displacement through the surface enclosing a volume is equal to the total charge within the volume.

3. State the principle of superposition of fields.

The total electric field at a point is the algebraic sum of the individual electric field at that point.

4. Define ohms law at a point

Ohms law at appoint states that the field strength within a conductor is proportional to current density.

5. Define self inductance.

Self inductance is defined as the rate of total magnetic flux linkage to the current through the coil.

6. Define pointing vector.

The vector product of electric field intensity and magnetic field intensity at a point is a measure of the rate of energy flow per unit area at that point.

7. State Lenz law.

Lenz's law states that the induced emf in a circuit produces a current which opposes the change in magnetic flux producing it.

8. What is the effect of permittivity on the force between two charges?

Increase in permittivity of the medium tends to decrease the force between two charges and decrease in permittivity of the medium tends to increase the force between two charges.

9. State electric displacement.

The electric flux or electric displacement through a closed surface is equal to the charge enclosed by the surface.

10. What is displacement flux density?

The electric displacement per unit area is known as electric displacement density or electric flux density.

11. What is the significance of displacement current?

The concept of displacement current was introduced to justify the production of magnetic field in empty space. It signifies that a changing electric field induces a magnetic field .In empty space the conduction current is zero and the magnetic fields are entirely due to displacement current.

12. Distinguish between conduction and displacement currents.

The current through a resistive element is termed as conduction current whereas the current through a capacitive element is termed as displacement current.

13. Define inductance.

The inductance of a conductor is defined as the ratio of the linking magnetic flux to the current producing the flux.

$L = N\Phi / I$

14. What is main cause of eddy current?

The main cause of eddy current is that it produces ohmic power loss and causes local heating.

15. How can the eddy current losses be eliminated?

The eddy current losses can be eliminated by providing laminations. It can be proved that the total eddy current power loss decreases as the number of laminations increases.

16.What is the fundamental difference between static electric and magnetic field lines?

There is a fundamental difference between static electric and magnetic field lines .The tubes of electric flux originate and terminates on charges, whereas magnetic flux tubes are continuous.

PART B QUESTIONS

1. Explain the relation between field theory and circuit theory.
2. Derive an expression for displacement, conduction current densities. Also obtain an expression for continuity current relations
3. Derive all the maxwells equations. i)Maxwells equation from electric Gauss law. ii) Maxwells equation from magnetic Gauss law. iii)Maxwells equation from Amperes law. iv) Maxwells equation from Faradays law.

4. State and explain Faradays and Lenzs law of induction and derive maxwells equation.

UNIT 4 - ELECTROMAGNETIC WAVE CHARACTERISTICS

1. Define a wave.

If a physical phenomenon that occurs at one place at a given time is reproduced at other places at later times , the time delay being proportional to the space separation from the first location then the group of phenomena constitutes a wave.

2. Mention the properties of uniform plane wave.

i) At every point in space ,the electric field E and magnetic field H are perpendicular to each other.

ii)The fields vary harmonically with time and at the same frequency everywhere in space.

3. Define intrinsic impedance or characteristic impedance.

It is the ratio of electric field to magnetic field.or It is the ratio of square root of permeability to permittivity of medium.

4. Give the characteristic impedance of free

space. 377ohms

5. Define skin depth

It is defined as that depth in which the wave has been attenuated to 1/e or approximately 37% of its original value.

6. Define Poynting vector.

The pointing vector is defined as rate of flow of energy of a wave as it propagates.

P =E X H

7. State Poynting Theorem.

The net power flowing out of a given volume is equal to the time rate of decrease of the the energy stored within the volume- conduction losses.

8. Give significant physical difference between poisons and laplace's equations.

When the region contains charges poisons equation is used and when there is no charges laplaces equation is applied.

9. Give the difficulties in FDM.

FDM is difficult to apply for problems involving irregular boundaries and non homogenious material properties.

1. **Explain the steps in finite element method.**

   a. Discretisation of the solution region into elements. ii) Generation of equations for fields at each element iii) Assembly of all elements
   iv) Solution of the resulting system

11. What are uniform plane waves?

Electromagnetic waves which consist of electric and magnetic fields that are perpendicular to each other and to the direction of propagation and are uniform in plane perpendicular to the direction of propagation are known as uniform plane waves.

12. Write short notes on imperfect dielectrics.

A material is classified as an imperfect dielectrics for ó <<ùå, that is conduction current density is small in magnitude compared to the displacement current density.

13.What is the significant feature of wave propagation in an imperfect dielectric ?

The only significant feature of wave propagation in an imperfect dielectric compared to that in a perfect dielectric is the attenuation undergone by the wave.

14.What is the major drawback of finite difference method?

The major drawback of finite difference method is its inability to handle curved boundaries accurately.
h and bound algorithm?

PART B QUESTIONS

1. A uniform plane wave of 200 MHz, traveling in free space Impinges normally on a large block of material having εr =4 , μr =9 and σ =0. Calculate transmission and reflection co efficient of interface.

2.What are the different ways of EMF generation? Explain with the governing equations and suitable practical examples.

3. With necessary explanation, derive the maxwell's equation in differential and integral forms

4. Write short notes on faradays law of electromagnetic induction.

5. What do you mean by displacement current? write down the expression for the total current density

6.In a material for which σ=5 s/m and εr=1 and E=250 sin 1010t (V/m). find the conduction and displacement current densities.

7.Find the total current in a circular conductor of radius 4mm if the current density Varies according to J=104/R A/m2 .

8. The magnetic field intensity in free space is given as H=H0sinθ ay t A/m. where θ=ωt-βz and β is a constant quantity. Determine the displacement current density.

9. Show that the ratio of the amplitudes of the conduction current density and displacement current density is σ/ωε,for the applied field amplitude ratio if the applied field is E=Em e-t/λ where λ is real.

10. Calculate the attenuation constant and phase constant for the uniform plane wave with the frequency of 10GHz in a medium for which μ=μ0, εr=2.3 and σ=2.54x10^-4Ω/m

11. Derive the expression for the attenuation constant ,phase constant and intrinsic impedance for a uniform plane wave in a good conductor.

12. Derive the one dimensional general wave equation and find the solution for wave equation.

13. Discuss about the plane waves in lossy dielectrics.

14. Discuss about the plane waves in lossless dielectrics.

15. Briefly explain about the wave incident

(i) Normally on perfect conductor

(ii) Obliquely to the surface of perfect conductor.

16. Briefly explain about the wave incident

(i) Normally on perfect dielectrics

(ii) Obliquely to the surface of perfect dielectrics.

17. Assume that Eland H waves, traveling in free space, are normally Incident on the interface with a perfect dielectric with $\varepsilon r=3$ .calculate the magnitudes of incident, reflected and transmitted E and H waves at the interface.

8. E-Resources (CMREC Repositories)

1. http://119.235.53.233:55557/index.php/e-books-menu/book-boon/ebooks-electrical-electronics-menu
2. http://119.235.53.233:55557/index.php/others/staff-published-articles/cse/cse/category/2350-transmissionlines-and-em-waves
3. http://119.235.53.233:55557/index.php/mit-courses-menu/eee-ece-cse/613-electromagnetic-wave-theory

9. Expert Details (Guest Lect. / Seminars)

10. Assignment / Innovative Assignment Question

Assignments

MID ASSIGNMENT: 1

SET1

1. a) State & explain coulombs law in vector form. (CO1)

b).Four point charges of each 10μc are placed in a free space at the points (1,0,0), (-1,0,0), (0,1,0) & (0,-1,0) respectively. Determine the force on a point charge of 30μc located at a point (0,0,1). (CO2)

2. a) Derive the expression for the energy stored in an electrostatic field.(CO1)

b).What is the amount of energy stored in a parallel plate capacitor.(CO2)

3. a). Derive Poisson's and Laplace's equations and mention their applications.(CO1)

b).If $V=\frac{1}{\rho}\cos\Phi+z$. Find out potential field satisfies laplacian equation.(CO2)

4. State & give Biot-Savart’s law.(CO1)

SET2

1. **1.** Derive expressions for Electric Field Intensity due to infinite length of conductor. (CO1)
2. **2.** a) State & explain Gauss's law and its applications.(CO1)

b) Find out Electric Flux Density at a point (4,5,-6) due to a line charge of 20μC/m placed at y=-4. (CO2)

3. **3.** a) State & explain maxwell's equations for static electric fields.(CO1)

b) Find out amount of workdone in moving point charges 10μC, 20μC, -30μC from infinity to a field of a point charge V=10xyz.

4. **4.** a) Distinguish between convection & conduction currents.(CO1)
   b) Find out H at the center of a circular conductor.(CO1)

SET 3

1. **1.** a) Derive expression for current continuity equation.(CO1)
   b) What is Relaxation time" and discuss its effect on conductors? (CO1)
2. **2.** Define the following terms i) Electric Field Intensity (E)
   ii) Electric Potential (V)
   iii) Electric Flux Density (D)
   iv) Isotropic & Homogeneous Dielectrics (CO1)
3. **3.** If $J=10xya_x+5y^2a_y+2za_z$. Find the total current passing through the surface and also find ρ_v if $0<x,y,z<5$. (CO2)
4. **4.** Define the following terms i) Biot-savart's law
   ii) Magnetic Flux Density (B)
   iii) Ampere's circuit law (CO1)

<u>EMFW -MID ASSIGNMENT: 2</u>

Set 1

1. A)Define voltage reflection coefficient and current reflection coefficient B) Derive the expression for input impedance of lossy dielectrics(CO3)
2. Explain transformer emf and motional emf (CO3)
3. Define reflection coefficient and transmission coefficient of plane wave at normal incidence (CO3)
4. Define phase velocity, group velocity, lossless line, distortionless line(CO4)
5. A distortionless line has Z_0=60Ω, α=20 mNp/m, u=0.6c, where c is the speed of light in a vaccum find R,L,G,C ,λ at 100M Hz. (CO4)

Set 2

1. Explain displacement current and define maxwell's equations in time varying fields(CO3)
2. A telephone line has R=30Ω/km,L= 100 mH/km, c= 20μF/km at f= 1kHz, obtain characteristic impedance of the line , propagation constant, velocity. (CO3)
3. Explain UHF Lines,λ/4lines ,λ/2 lines(CO5)
4. A) Explain skin depth B) A uniform plane wave propagating in a medium has

$\mathbf{E} = 2e^{-\alpha z}\sin(10^8t-\beta z)\mathbf{a_y}$ v/m if the medium is characterized by ε_r=1, μ_r=20 and σ=3 S/m, find α,β and **H**(CO3)

5. Explain OC lines, SC lines, Matched line and Derive Z_0 in terms of Z_{SC} and Z_{OC}(CO5)

Set 3

1. A) explain maxwell's equations for Time harmonic fields b)In a medium characterized by σ=0,μ=μ_0, ε=ε_0 and $\mathbf{E}$= 20 $\sin(10^8t-\beta z)\mathbf{a_y}$ v/m calculate β, **H.** (CO3)
2. A)Explain parameters of transmission lines, primary and secondary constants

   B)Derive the expression for propagation constant and characteristic impedance interms of primary constants(CO4)

3. Derive the condition for minimum attenuation and distortion less line(CO4)

4. Explain UHF Lines(λ/4,λ/8 lines)adnd derive input impedance of λ/4, λ/2 lines(CO5)
5. Define reflection coefficient and transmission coefficient of plane wave at Oblique incidence (parallel polaization) (CO3)

INNOVATIVE ASSIGNMENT QUESTIONS

1. Make an extensive study on impact of Electric and magnetic fields caused by power transmission lines(ESSAY type)
2. Give an analytical view on 1200 KV, AC transmission line, India's most prestigious forthcoming project.(ANALYSIS)
3. Design a non-contact probe that can detect the presence and polarity of a static (or slowly varying) electric field in air(Project based)
4. Design a non-contact AC current meter. (Project based)

11. Important Question sets on each unit

12.List of topics for student's seminars

1. Capacitance – Parallel Plate, Coaxial, Spherical Capacitors
2. Maxwell's Equations in Different Final Forms and Word Statements
3. Ampere's Circuital Law and ApplicatiOns
4. Polarization
5. Surface Impedance

6. Loading - Types of Loading

7. $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines – Impedance Transformations

MICROPROCESSORS& MICROCONTROLLERS

SubjectCode:EC501PC

Class:IIIYearB.Tech ECE I Semester

BY
D. LATHA
ASSISTANT PROFESSOR

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

CMR ENGINEERING COLLEGE

S.NO **CONTENT**

(1) - Preamble/Introduction
(2) - Prerequisites
(3) - Objectives and Outcomes
(4) - Syllabus
1.JNTU/R20-CMREC
2.GATE
3.IES
(5) - List of Expert Details(Local/National/International with Contact details/Profile link/Blogs/their research Contribution towards the subject)
(6) - Journals with min 5 ref paper for literature study
(7) - Subject -Lesson plan
(8) - Suggested Books (prescribed and References)
(9) - Websites for self learning Resources like *www.geeksforgeeks.org, www.schools.com, Coursera,edX, Udemy, Khan Academy*, NPTEL etc along Registration procedures*)*
(10) - Question Banks
1.JNTUH/Model papers
2.GATE
(11) - Two case study presentations with Project / Product/ Model /prototypes/ Industrial applications.
(12) - Assignment Question/Innovative Assignments sets.
(13) -List of topics for studentsSeminars with Guidelines
(14) - STEP/Course material in softcopy
(15) - Expert Lectures with topics & Schedules

1. Preamble/Introduction:

This course introduces the basic concepts of Assemblylanguage programming of microprocessors & Microcontrollers. The emphasis of this course is laid on the basic interfacing techniques of microprocessor,microcontroller with other devices.

To make the students understand Microprocessors and Microcontrollers in order to equip them with the necessary tools for the analysis of Electronic equipment in the field of Microprocessors & Embedded systems to be used in industries, research field and in commercial field applications.

The applications of this subject include Real time applications like Washing machines, Smart phones, computers, Laptops etc.. and also used in some toys, traffic lights, design of robots etc

2. Prerequisites:

This subject recommends basic knowledge & practice on

- Digital Logic Design concepts
- Computer Organization & Architecture concepts
- Basics of Digital IC's

3. Objectives:

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

Outcomes:

Uponcompletionofthesubject,studentswillbe ableto:

- Identify and analyze the internal organization, design of 8086 microprocessor and its pins description.
- Develop and interpret simple Arithmetic and Logical programs using different instructions and addressing modes of 8051 microcontroller.
- Apply and Design the concepts of interfacing microcontroller with I/O devices, different advanced devices and serial data communication standards.
- Examine the internal architecture and organization of ARM processors along with pins description, Classify different instructions and addressing modes.
- Understand the internal architecture and organization of Cortex and OMAP processors.

4. Syllabus:

1. JNTUH-R18

UNIT-I

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

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

UNIT – II

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/OPorts, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External HardwareInterrupts, Programming the Serial Communication Interrupts, Programming 8051 Timersand Counters

UNIT –III

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

Serial Communication and Bus Interface: Serial Communication Standards, Serial DataTransfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; ExternalCommunication Interfaces-RS232,USB.

UNIT –IV

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

UNIT – V

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

2. GATE

- 8086 Architecture, Instruction Set and Assembly Language Programming of 8086
- Introduction to Microcontrollers, 8051 Real Time Control

3.IES

- Microprocessors:

Architecture and instruction set of Microprocessor 8086, Assembly language Programming.

5. List of Expert Details:

- Douglas V. Hall- State University of New York at Albany
  Phone: (503) 725-5396, Email:halld@pdx.edu
- A K Ray Ph.D.(IIT Kharagpur) Professor
  E-mail- ajoy_ray2004@yahoo.com
- LAXMIDHAR BEHERA, Indian Institute of Technology – Kanpur
  Phone: +91-512-2597198, Email: lbehera@iitk.ac.in
- Prof. Roopa R Kulkarni, GIT, Belgaum
  Email: roopa.patavardhan@gmail.com/roopakulkarni-ece@dsatm.edu.in
  Contact Number: +919880156678
- Dr.N. D. Tiwari, Professor, NRCM, Hyderabad
  Contact number: 9165437352

6. Journals with min 5 reference papers for literature study:

- Smart Home Automated Control System Using Android Application and Microcontroller
  https://www.ijser.org/researchpaper/Smart-Home-Automated-Control-System-Using-Android-Application-and-Microcontroller.pdf
- A PLL clock generator with 5 to 110 MHz of lock range for microprocessors
  https://ieeexplore.ieee.org/document/165341
- Energy dissipation in general purpose microprocessors
  https://ieeexplore.ieee.org/document/535411
- A 160-mhz, 32-b, 0.5-w CMOS RISC microprocessor
  https://ieeexplore.ieee.org/document/542315
- Design and Implementation of Microcontroller Based Automatic Solar Radiation Tracker
  http://inpressco.com/wp-content/uploads/2014/04/Paper49230-234.pdf

7. Subject Lesson Plan:

Topic Name	No. of classes	Text books
UNIT I:8086 Architecture		
8086 Architecture	02	T1, R2
Functional diagram	02	T1, R2
Register Organization	01	T1, R2
Memory Segmentation, Memory addresses	01	T1, R2
Physical Memory Organization	01	T1, R2
interrupts of 8086, Instruction formats	01	T1, R2
Addressing modes	02	T1, R2
Instruction Set	02	T1, R2
Assembler Directives, Macros	01	T1, R2
Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations	02	

Total No. of Classes	**15**	
UNIT II:Introduction to Microcontrollers		
Overview of 8051 Microcontroller	01	T1, R1,R3
Architecture, I/O Ports	01	T1, R1,R3
Memory Organization	01	T1,R1,R3
Addressing Modes and Instruction set of 8051	02	T1,R1,R3
Programming Timer Interrupts	02	T1,R1,R3
Programming External Hardware Interrupts	01	T1,R1,R3
Programming the Serial Communication Interrupts	02	T1,R1,R3
Programming 8051 Timers and Counters	02	T1,R1,R3
Total No. of Classes	**12**	
UNIT III:I/O and Memory Interface		
LCD Interface to 8051	01	T1,R2,R3
Keyboard Interface to 8051	01	T1,R2,R3
External Memory RAM, ROM Interface	02	T1,R2,R3
ADC, DAC Interface to 8051	02	T1,R2,R3
Serial Communication Standards, Serial Data Transfer Scheme	02	T1,R2,R3
On board Communication Interfaces-I2C Bus, SPI Bus, UART	03	T1,R2,R3
External Communication Interfaces-RS232,USB	02	T1,R2,R3
Total No. of Classes	**13**	
UNIT IV:ARM Architecture		
ARM Processor fundamentals	01	T2
ARM Architecture	02	T2
Register, CPSR	02	T2
exceptions and interrupts interrupt vector table	02	T2
ARM instruction set – Data processing, Branch instructions, load store instructions	02	T2
Software interrupt instructions, Program status register instructions	02	T2
loading constants, Conditional execution	01	T2
Introduction to Thumb instructions	02	T2
Total No. of Classes	**14**	
UNIT V:Advanced ARM Processors		
Introduction to CORTEX Processor and its architecture	03	T2,R4
OMAP Processor and its Architecture	02	T2,R4
Total No. of Classes	**05**	
Total No. of Classes	**59**	

8. Suggested Books:

TEXT BOOKS:

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

REFERENCE BOOKS:

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao,Andhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay,WILEY 2012.

9. Websites for self learning Resources:

1. NPTEL VIDEO LECTURES:
   https://nptel.ac.in/courses/108/105/108105102/
   https://nptel.ac.in/courses/117/104/117104072/
2. https://www.youtube.com/watch?v=iV4TPnOLvgA
3. https://www.youtube.com/watch?v=Po6Wyb1ltIk
4. https://www.youtube.com/watch?v=0-ljoBEi-WE
5. https://www.youtube.com/watch?v=liRPtvj7bFU-Introduction to Microprocessors & Microcontrollers .

10. Question Banks

1.JNTUH/Model papers

R16

CodeNo:136CT

JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITYHYDERABAD

B. Tech III Year II Semester Examinations, May - 2019MICROPROCESSORSANDMICROCONTROLL ERS

(ElectronicsandCommunicationEngineering)

Time:3hours **Max.Marks:75**

Note: Thisquestionpapercontainstwopartsand B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part Bconsists of 5 Units. Answer any one full question from each unit.Each question carries10 marks and mayhavea, b, cas sub questions.

PART-A

(25Marks)

Whatis theimportanceof pipeliningconcept in 8086microprocessor? [2]
b) Howto calculatethe Physical memoryof 8086, with oneexample? [3]
c) Explaintheimportanceof8051Microcontrollerover microprocessor. [2]
d) ListoutDifferentinterrupts of8051Microcontroller. [3]
e) Explain the importanceof Memoryinterfacingof8051. [2]
f) Writeshort noteson USB. [3]
g) Listoutdifferent 16-bitregistersusedinARMprocessor. [2]

h) Listoutfew comparisonsofARMandMicrocontroller. [3]
i) ExpandOMPAprocessorandits memorycapacity. [2]
j) Explainthedifferentapplicationsof OMPAprocessor. [3]

PART-B

(50Marks)

2.a) Drawtheinternalarchitectureof8086microprocessorandexplainthefunctionofeachblock indetail.
b) Listoutdifferentstringmanipulationinstructionsused in8086 microprocessorandexplain each onein detail. [5+5]

OR

3.a) DefineAddressingmode?ListoutdifferentAddressingmodesusedin8086microprocessor.
b) DefineMacro?Explainitsimportancein8086programming. [6+4]

4.a) Listouttheimportantfuturesof 8051Microcontrolleralong withitsapplications.
b) DrawthePinDiagram of 8051 Microcontroller and explain eachpin indetail. [5+5]

OR

5. ExplainthefollowingSFRsof8051 Microcontrollerindetail:
a) SCON b)TCON c)PCON [3+3+4]

6.a) DrawtheinternalcircuitdiagramofUARTandexplainthefunctionofeachblockindetail.
a) Explainthe differentSerial datatransfer schemesusedin serialcommunication. [5+5]

OR

7.a) DrawthePINdiagramofRS-232serialcommunicationschemeand explainimportanceofeach pin.
b) Drawtheinterfacecircuitdiagramof LCDwith8051andexplainitsoperationindetail. [5+5]

8.a) DrawtheinternalarchitectureofARMprocessorandexplainfunctionofeachblockindetail.
b) DefinePipeline?Explainthe Fivestagepipelineconceptin ARMprocessor. [5+5]

OR

9.a) ListoutdifferentBranchinstructionsusedinARMprocessorandexplaineachoneindetail.
b) Explaintheconcept ofSoftwareinterrupt instructionin detail. [5+5]

10. ListoutdifferentclassificationsofOMPAprocessorandexplaineachonetypeindetail. [10]

OR

11.a) ExplaintheconceptofsuperscalarpipelineofCORTEXprocessoralongwithcircuitdiagram.
b) Explainthedifferentapplicationsof CORTEXprocessorindetail. [5+5]

III B.Tech. II Semester Regular/Supplementary Examinations, May/June -2014

MICRO PROCESSORS AND MICRO CONTROLLERS

(Comm to Electronics and Communication Engineering and Electronics and Computer Engineering and Biomedical Engineering and Electronics and Instrumentation Engineering)

Time: 3 Hours Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks
*****

1. a) Explain the function of QS0 and Qs1 signals of 8086.

b) Present the architectural differences between 8086 and 8088.

c) Draw and discuss read cycle timing diagram of 8086 in minimum mode. (3+6+6)

2. a)Write an ALP to authenticate the given password .

b) Draw and discuss interrupt structure of 8086 in detail.

c) Describe the procedure to code intersegment jump and intrasegment jump. (6+6+4)

3. a) Write the salient features of strobed I/O mode of operation of 8255. Also present the input and output control signal definitions.

b) Design an interface between 8086 CPU and two chips of 16K X 8 EPROM and two chips of 32K X 8 RAM. Select the starting address of EPROM suitably. The RAM address must start at 00000H. (7+8)

4. a) Draw and explain the internal architecture of 8257.

b) Explain the initialization sequence of 8259A using a flow chart.

c) Explain the FIFO status word of 8279. (6+5+4)

5. a) Draw and discuss the register set of 80386 and explain the function of each of the registers in brief. (9+6)

b) Explain the different additional addressing modes supported by 80386 over 80286.

6. a) Draw the 8051 connection diagram and explain. (5+10)

b) Explain different addressing modes of 8051 using relevant example instructions.

7. a) Explain the function of each bit of STATUS register in PIC 16F8XX.

b) Write the features of I/O ports of PIC 16F877. (6+9)

8. Discuss in detail ARM architecture and organization. (15)

R16

Code No: 135BF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, October - 2020

MICROPROCESSORS AND MICROCONTROLLERS

(Common to EEE, EIE)

Time: 2 hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

- - -

1.a) Draw the flag register of 8086 microprocessor and explain each flag.
b) What are interrupts? What are their uses? List and explain different interrupt supported by 8086 microprocessor. [7+8]

2.a) Discuss different string instruction of 8086 microprocessor with examples.
b) List and explain different addressing modes supported by the 8086 microprocessor. [7+8]

3.a) With a neat diagram, explain the internal architecture of 8051 microcontroller.
b) List the applications of 8051 microcontrollers. [8+7]

4.a) Discuss the internal memory organization of 8051 microcontroller.
b) Explain the use of timers and counters available in 8051 microcontroller. [7+8]

5.a) Compare between serial communication and parallel communication.
b) What are D-to-A controllers? Explain their applications. [8+7]

6.a) What is RS232? Explain its interfacing with 8051.
b) Explain the working of I2C Bus. [8+7]

7.a) Draw and explain the program status register of ARM processors.
b) Discuss the main characteristics of ARM instruction set. [7+8]

8.a) List and discuss the features of OMAP Processor.
b) What is a cache memory? What is its use in microcomputers? [7+8]

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11. Case study presentations:

- **Project 1: DTMF Controlled Home Automation System Circuit**

The main principle of this circuit is to control appliances like light and fan using DTMF technology. DTMF encoder is present in your mobile and decoder is HT9107B IC. Mobile jack is connected at 1nf capacitor. Mobile jack consists of two wires (Red and black). Red wire is connected to the decoder IC and Black is grounded. When a button is pressed from mobile it generates a tone which is decoded by the decoder IC and it is sent to ATMEGA8 controller. Controller then checks for input and it produces the output according to the code written to it.

- **Project 2: Street Lights that Glow on Detecting Vehicle Movement**

Street lights are switched on depending on the intensity of the Sun light on LDR. If the intensity of Sunlight on light dependent resistor is low, its resistance value is high. This value increases and becomes high when it is completely in dark. This resistance value decides when the street lights are required to switch ON.

As the resistance value is maximum in the midnights, real time clock comes into the play. The controller checks peak time during which there is no traffic and switch OFF the lights. When there is any vehicle on the road, it is detected by the PIR sensor.

Whenever PIR sensor is detected it just indicates the microcontroller to switch on the street lights. Then lights are switched on for 2 to 3 minutes and switched off automatically.

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12. Assignment Questions:

ASSIGNMENT: 1

SET:1

1. Data transfer instructions, Arithmetic and Logical Instructions, Branch Instructions
2. Draw and Explain the pin diagram of 8086 in minimum mode
3. Explain the Flag register of 8086.
4. Explain Memory segmentation
5. a)Write a program to copy value 1020 h into 6 memory locations starting from 3000h
   b) Write a program to perform 16-bit multiplication and store the resultant into 4000h

SET:2

1. Explain the Addressing modes of 8086
2. String Manipulation Instructions
   Rotate and shift Instructions
3. Draw and explain the pin diagram of 8086 in maximum mode.
4. Write a ALP for sorting of array having word data.
5. Explain the register organization of 8086.

SET:3

1. Write an ALP for conversion of packed BCD to ASCII.
2. Draw and explain the pin diagram of 8086 in minimum mode.
3. a)Write a program to copy value 1020 h into 6 memory locations starting from 3000h
   b) Write a program to perform 16-bit multiplication and store the resultant into 4000h
4. Explain the physical memory organization of 8086.

SET:4

1. Explain the Addressing modes of 8086
2. Explain the string instructions.
3. Write an ALP for conversion of packed ASCII to BCD.
4. Draw and Explain Architecture of 8086.
5. Draw and explain the pin diagram of 8086 in minimum mode.

ASSIGNMENT: 2

SET:1

1. Explain the USART architecture
2. Interfacing of ADC with 8086
3. Addressing modes of 8051
4. Explain counters and timers of 8051
5. Explain the Architecture of 8051

SET:2

1. Explain various operation modes of Timer-1 and Timer-0.
2. Explain the alternate functions of Port-0, Port-2 and Port-3.
3. Memory organization of 8051 & interrupts of 8051
4. Briefly discuss about the serial communication standards
5. Write a program to generate 2 kHz square wave using timer.

SET:3

1. Write a program to generate 2 kHz square wave using timer.
2. Explain about arm processor architecture
3. Explain about arm interrupts & exceptions
4. Explain about arm register set
5. Draw and explain Cortex processor architecture

SET:4

1. What is the difference between microprocessor and microcontroller? Give 8051 architecture
2. Explain the USART architecture.
3. Explain the memory organization of 8051.
4. Write a program to generate 2 kHz square wave using timer.
5. Addressing modes of 8051.

UNIT WISE QUESTIONS:

Unit:1

1.a) Write an ALP to find the sum of number in the array of 10 elements.

b) Explain the concept of segmented memory.

2.a) Define the term Macro’s & Assembler directives.

b) What is meant Physical Memory organization in 8086 microprocessor.

3.a) What is meant by register organization in 8086 microprocessor.

b) Draw the flag register of 8086 microprocessor & explain function of each flag.

4.a) Explain about the minimum mode pins of 8086 microprocessor in detail..

b) Explain the maximum mode pins of 8086 microprocessor in detail.

5.a) Explain the architecture of 8086 microprocessor with a neat sketch.

b) Describe the assembler directives of 8086 microprocessor

i) DW ii) SEGMENT iii) PROC and ENDP iv) ASSUME v) DUP

6. Draw the pin diagram of 8086 microprocessor and explain each pin function in it.

7. Explain the interrupts in 8086 microprocessor and draw the interrupt structure.

Unit:2

1. Explain about TCON & TMOD special function registers with a diagram in 8051 microcontroller.

2.a) Draw & explain the following SFR's

(i) IE (ii) IP

b) Draw the PSW of 8051 microcontroller.

3. Draw the internal architecture of 8051 microcontroller.

4.a) Describe about the memory organization in 8051 microcontroller.

b) What is the function of port-3 of 8051.

5.a) Write an Overview of 8051 microcontroller

b) Describe about the timer mode 0 with a neat sketch in 8051 microcontroller.

6. Mention about the programming of timer interrupts

7. Write short notes on external hardware interrupts

Unit :3

1.a) Draw the internal diagram of Keyboard interfacing to 8051.

b) Explain the concept of External RAM interfacing along with block diagram

2.a) Draw the internal diagram of LCD interfacing to 8051.

b) Explain the concept of External ROM interfacing along with block diagram

3. Explain about following protocols in serial communication

a) I2C b) USB

4.Explain about following protocols in serial communication

a) SPI b) UART

5.a) Write short notes on RAM and ROM.

b) Explain about the interfacing of ADC with 8051 microcontroller.

6.a) What is meant by ADC and DAC

b) Draw a neat sketch of DAC to be interfaced with 8051 microcontroller.

7.a) Explain about the architecture of UART to be connected to 8051 microcontroller.

b) Write short notes on serial communication standards.

Unit: 4

1.a) List features of ARM Processor.

b) Draw and explain the architecture of ARM processor.

2.a) Explain Interrupt vector table of ARM processor.

b) Draw the ARM core data flow model.

3.a) Define term Loading constants.

b) Explain about instruction set of ARM processor..

4.a) Write short notes on registers in ARM.

b) Mention about the program status register instructions in ARM processor.

5.a) Write short notes on current program status register in ARM.

6. What is the need of Thumb instruction set and explain its instructions.

7.a) Define conditional execution.

b) Briefly explain about pipeline and exceptions of ARM.

Unit: 5

1. List the features and applications of CORTEX family processors.
2. Explain CORTEX processor architecture along with block diagram.
3. Write the features and applications of OMAP processor..
4. Explain about Open Multimedia Application Platform (OMAP) architecture.
5. Mention external interfaces on Cortex processor.
6. Mention the features of low cost debug solution in CORTEX.
7. Briefly give the different families of versions in CORTEX & OMAP.

13.LISTOFTOPICSFORSTUDENTSEMINARS

- 7-Segment Display Interfacing
- RS-232
- Pin and Block diagram of 8086
- Applications of Microprocessors, Microcontrollers
- Role of Microprocessors in Embedded Systems
- Serial communication Techniques
- Timing diagram of 8051
- ARM Processor and its advantages
- Advanced ARM processor and its features with Applications

14.STEP/Course material in softcopy

Mpmc notes pdf.pdf

15. Expert Lectures with topics & Schedules

Expert Name	Topic
Dr Sudha Aravind	Addressing modes and Instruction set of Microprocessor and Microcontroller
Dr Sudha Aravind	ALP for Microprocessor
Dr J L Divya Shivani	ARM Processor

CONSTITUTION OF INDIA

Subject Code: MC509

Class: III Year B.Tech ECE I Semester

BY
MRS. TAHSEEN FATIMA ANSARI
ASSISTANT PROFESSOR

DEPARTMENT OF HUMANITIES & SCIENCES

CMR ENGINEERING COLLEGE

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1.Preamble/Introduction:

This course enables the student to understand the importance of constitution, structure of executive, legislature and judiciary, fundamental rights and duties, the autonomous nature of constitutional bodies like Supreme Court and high court, controller and auditor general of India and election commission of India.

2.Prerequisites:

NIL

3.Objectives:

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

Course Outcomes:

Upon completion of the subject, students will be:

C 1: Able to understand historical background of the constitutional making and its importance for building a democratic India, the structure of Indian government, the structure of state government, the local Administration,

C2 : Able to apply the knowledge on directive principle of state policy, the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

C3: Able to analyze the History, features of Indian constitution, the role Governor and Chief Minister, role of state election commission, the decentralization of power between central, state and local self-government.

C4 : Able to evaluate Preamble, Fundamental Rights and Duties, Zilla Panchayat, block level organization, various commissions of viz SC/ST/OBC and women.

4.Syllabus:

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States

8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

GATE

NIL

IES

NIL

5.List of Expert Details:

- M.P. Singh, Chanellor, University of Haryana

6. Journals with min 5 reference papers for literature study:

NIL

7. Subject Lesson Plan:

Topic Name	No. of classes	Text books
Meaning of the constitution law and constitutionalism	1	T1
Historical perspective of the Constitution of India	1	T1
Salient features and characteristics of the Constitution of India	1	T1
Scheme of the fundamental rights	1	T1
The scheme of the Fundamental Duties and its legal status	1	T1
The Directive Principles of State Policy – Its importance and implementation	1	T1
Federal structure and distribution of legislative and financial powers between the Union and the States	1	T1
Parliamentary Form of Government in India – The constitution powers and status of the President of India	1	T1
Amendment of the Constitutional Powers and Procedure	1	T1
The historical perspectives of the constitutional amendments in India	1	T1
Emergency Provisions: National Emergency, President Rule, Financial Emergency	1	T1
Local Self Government – Constitutional Scheme in India	1	T1
Scheme of the Fundamental Right to Equality	1	T1

Scheme of the Fundamental Right to certain Freedom under Article 19	1	T1
Scope of the Right to Life and Personal Liberty under Article 21	1	T1
Total No. of Classes	**15**	

8. **Suggested Books:**

TEXT BOOKS:

1. V.N. Shukla's Constitution Of India By Prof (Dr.) Mahendra Pal Singh
2. CONSTITUTION OF INDIA 2021 EDITION BY VN SHUKLA By VN SHUKLA

REFERENCE BOOKS:

1. CONSTITUTION OF INDIA By P K AGRAWAL

9. **Websites for self learning Resources:**

- https://legislative.gov.in/constitution-of-india
- https://www.india.gov.in/my-government/constitution-india
- https://www.constitutionofindia.net/constitution_of_india
- https://byjus.com/free-ias-prep/constitution-of-india-an-overview/

10. **Question Banks**

1) What is meant by constitution? Explain salient features and characteristics of Indian constitution
2) Describe constitutionalism and also write about historical background making of Indian constitution
3) Illustrate fundamental rights and fundamental duties of Indian citizen
4) What is DPSP and how it is implemented by Government?
5) Write about Federal structure and how power are distributed between states and union?
6) What is meant by Amendment? Define powers and procedure of amendments in Indian constitution
7) Define local self government. Explain constitutional scheme of India
8) Write the following terms
   a) Preamble
   b) Sources of constitution
   c) Indian independence act 1947
   d) Quasi Federal Government

11. **Case study presentations:**

NIL

12. **Assignment Questions:**

NIL

13. LIST OF TOPICS FOR STUDENT SEMINARS

NIL

14. **STEP/Course material in softcopy**

COI Notes.rar

15. **Expert Lectures with topics & Schedules**

NIL

DIGITAL SIGNAL PROCESSING LABORATORY

1. OBJECTIVES AND RELEVANCE

2. SCOPE

3. PREREQUISITES

4. SYLLABUS AS PER JNTUH

5. LEAD EXPERIMENT

6. VIRTUAL LAB EXPERIMENT

7. SUGGESTED BOOKS

8. WEBSITES (USEFUL LINKS)

9. EXPERT DETAILS

10. (A)LAB SCHEDULE

(B)VIVA SCHEDULE

(C)SCHEME OF EVALUATION

11. PROJECT/PRODUCT/PAPER BASED LEARNING

12. MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D PROPOSALS

13. GUIDELINES FOR SHADOW ENGINEERING AND INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM)

14. ACTIVITIES IN LIFT PROGRAM

15. MAINTAINANCE AND TROUBLESHOOTING

16. ASSESSMENT AND ACCREDITATION PROCESDURE AS PER NABL

1. OBJECTIVE AND RELEVANCE:

- To emphasize the teaching of key DSP concepts , such as overview of discrete time signal and systems in time domain, and frequency domain, sampling and reconstruction of analog signals, signal and systems representation in complex frequency domain, solution of differential equations using z transform, computation of Fourier transform and its efficient implementation, Discrete Fourier transform and Fast Fourier transform, Structure for the implementation of digital filters, FIR Filter design and IIR Filter Design
- To provide an understanding of how to design signal processing systems and Process data in a software simulation like using MATLAB.
- Digital Signal Processing (DSP) can be described as the processing of signals using digital techniques or digital computers. A signal is a piece of information in binary or digital form. Digital Signal processing techniques improve signal quality or extract important information by removing unwanted part of the signal.

2. SCOPE:

1. The lab helps the students in designing and simulation of various DSP based circuits. The lab is equipped with MATLAB software.
2. The goal of DSP is usually to measure, filter and/or compress continuous real-world analog signals. But to deal with real life analog signals from our environment, it is necessary to convert them to digital form, and vice-versa. This lab boasts of plenty of powerful computers preinstalled with MATLAB and Code Composer Studio (CCStudio), and high-speed Digital Signal Processors of the TMS320C6713 Digital Starter Kit (DSK) family by Texas Instruments. Using these, students are able to perform real-time analysis of signals and get hands-on experience about the theory they have learned in the class. This is used as regular lab for undergraduate students. Some research scholar uses this lab for development of algorithms which can be ported to hardware for real time applications.

3. PREREQUISITES:

The prerequisites for this lab are signals and systems, General mathematical formulas and basic knowledge in digital signal including the fundamentals.

4. **JNTUH SYLLABUS:** The lab course should be planned as per the JNTUH syllabus. In this, LEAD experiments should also be included in cycle of experiments

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. Histogram of White Gaussian Noise and Uniformly Distributed Noise.
3. To find DFT / IDFT of given DT Signal
4. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
6. Implementation of FFT of given Sequence
7. Determination of Power Spectrum of a given Signal(s).
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Generation of Narrow Band Signal through Filtering
11. Generation of DTMF Signals
12. Implementation of Decimation Process
13. Implementation of Interpolation Process
14. Implementation of I/D Sampling Rate Converters
15. Impulse Response of First order and Second Order Systems.

EXPERIMENT NO. 1

Generation of Sinusoidal waveform/Signal based on recursive difference equations

OBJECTIVE

We generate the sinusoidal wave form and we will save the output samples in a buffer array and

Inspect the generated waveform both in the time and frequency domains using CCS's graphing capabili-

ties.

PREREQUISITES

Knowledge of basic sinusoidal signal generation

DESCRIPTION

a. Introduction to experiment -30 min

b. Connection of experiment and its verifications

c. Experimental determination of sinusoidal wave form

d. Graphical determination of sinusoidal wave in time and frequency

APPLICATIONS

1. AC supply.
2. Linear network.

EXPERIMENT NO. 2

Histogram of White Gaussian Noise and Uniformly Distributed Noise.

OBJECTIVE

To find Histogram of White Gaussian Noise and Uniformly Distributed Noise using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c.Use the appropriate library function

d.Display the waveform

APPLICATIONS

1. Communication

EXPERIMENT NO. 3

To find DFT/IDFT of given DT signal

OBJECTIVE

1. To study and investigate the Discrete Fourier Transform
2. To learn how to implement the operation using MATLAB
3. To learn how to analyze discrete-time signal using DFT

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c.Use the appropriate library function

d.Display the waveform

APPLICATIONS

1. In Sinusoidal wave forms
2. In signals

EXPERIMENT NO. 4

To find frequency response of a given system given in (Transfer function/Differential equation form)

OBJECTIVE

We will generate the signal and we will find the frequency response of the given system in Transfer function /Differential equation form and graphical representation of the output signal.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1. Used to compute the coefficients of a discrete Fourier series.

EXPERIMENT NO.5

Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.

OBJECTIVE

To Obtain Fourier series coefficients by formula and using FET and compare for half sine wave using MATLAB.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in radio communications, Radars

EXPERIMENT NO.6

Implementation of FFT of given sequence

OBJECTIVE

To find the FFT of a given sequence using MATLAB.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

Communication, Signal processing

EXPERIMENT NO.7

Determination of Power spectrum of a given signal(s)

OBJECTIVE

To find the power spectrum of a given signal

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in radio communications, Radars

EXPERIMENT NO.8

Implementation of LP FIR filter for a given sequence.

OBJECTIVE

To find the frequency response of LP FIR filter.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1. Low pass filters are extensively used in the design of decimators and interpolators.

EXPERIMENT NO.9

Implementation of HP IIR filter for a given sequence.

OBJECTIVE

To find the frequency response of HP IIR filter.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used to remove noise in audio signals.

EXPERIMENT NO.10

Generation of Narrow Band Signal through Filtering

OBJECTIVE

To implement the Decimation process using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in filters to improve efficiency

EXPERIMENT NO.11

1. Generation of DTMF Signals

OBJECTIVE

To generate DTMF using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in communication

EXPERIMENT NO.12

Implementation of Decimation Process

OBJECTIVE

To implement the Decimation process using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in filters to improve efficiency

EXPERIMENT NO.13

Implementation of Interpolation Process

OBJECTIVE

To implement the Interpolation process using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in filters to improve efficiency

EXPERIMENT NO.14

Implementation of I/D sampling rate converters.

OBJECTIVE

To implement I/D sampling rate converters using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1. Used in Image processing

EXPERIMENT NO.15

Impulse Response of First order and Second Order Systems

OBJECTIVE

To Impulse Response of First order and Second Order Systems using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1. Used in Signal Processing

5. LEAD EXPERIMENT

Implementation DFT and IDFT on a Image: (With using built in functions)

OBJECTIVE

To find DFT and IDFT on a Image using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for image generation

c. Use the appropriate library function

d. Display images

APPLICATIONS

a. Used in image processing.

5. LEAD Experiment:
1)DFT and IDFT on a Image

Theory:

For processing 1-D or 2-D signals (especially coding), a common method is to divide the signal into “frames” and then apply an invertible transform to each frame that compresses the information into few coefficients.
Discrete cosine transform (DCT) can linearly transform data into the frequency domain, where the data can be represented by a set of coefficients. The advantage of DCT is that the energy of the original data may be concentrated in only a few low frequency components of DCT depending on the correlation in the data.
DCT express a signal (a set of numbers) in terms of a sum of cosine functions with different frequencies. For example, given a set A of n values,

$A = \{a_0, a_2, \dots, a_{n-1}\}$
one dimensional discrete cosine transform coefficients (actually the weights) are given by

$$w_k = \sum_{t=0}^{n-1} a_t \cos\left[\frac{\pi}{n}\left(t+\frac{1}{2}\right)k\right],\ k = 0, \dots, n-1$$

To make DCT values orthogonal, we multiply the terms by scale factors $1/\sqrt{2}$ and $\sqrt{2/n}$. Remember that if two lines are orthogonal if they are perpendicular at their point of intersection. Similarly, two vectors are orthogonal if and only if their dot product ($a \cdot b = \|a\|\|b\|\cos\theta$, where $\|a\|$ denotes the length or magnitude of a) is zero. Two vectors in an inner product space are orthonormal if they are orthogonal and both of unit length. This boring stuff are all related to DCT, but you can simply ignore if you are not interested in.

$$w_k = c_k \sqrt{\frac{2}{n}} \sum_{t=0}^{n-1} a_t \cos\left[\frac{\pi}{n}\left(t+\frac{1}{2}\right)k\right],$$

$$c_k = \begin{cases} \frac{1}{\sqrt{2}}, & k = 0 \\ 1, & k > 0 \end{cases}, \qquad k = 0, \ldots, n-1.$$

Let us rewrite w_0 for k=0 in the expanded form,

$$w_0 = a_0\sqrt{\frac{1}{n}}\cos\left[\frac{\pi}{n}\left(0+\frac{1}{2}\right)0\right] + a_1\sqrt{\frac{1}{n}}\cos\left[\frac{\pi}{n}\left(1+\frac{1}{2}\right)0\right] + a_2\sqrt{\frac{1}{n}}\cos\left[\frac{\pi}{n}\left(2+\frac{1}{2}\right)0\right] + \cdots + a_{n-1}\sqrt{\frac{1}{n}}\cos\left[\frac{\pi}{n}\left(n-1+\frac{1}{2}\right)0\right]$$

$$w_0 = \sqrt{\frac{1}{n}}(a_0 + a_1 + a_0 + \cdots + a_{n-1})$$

$$w_0 = \frac{a_0 + a_1 + a_0 + \cdots + a_{n-1}}{\sqrt{n}}.$$

The first coefficient w_0 is called as DC (direct current, zero frequency) coefficient, and $\frac{w_0}{\sqrt{n}}$ is simply the mean of the set A.

Let us rewrite the formulation for the rest of the coefficients (they are called as AC, alternative current coefficients):

$$w_k = a_0\sqrt{\frac{2}{n}}\cos\left[\frac{\pi}{n}\left(0+\frac{1}{2}\right)k\right] + a_1\sqrt{\frac{2}{n}}\cos\left[\frac{\pi}{n}\left(1+\frac{1}{2}\right)k\right] + a_2\sqrt{\frac{2}{n}}\cos\left[\frac{\pi}{n}\left(2+\frac{1}{2}\right)k\right] + \cdots + a_{n-1}\sqrt{\frac{2}{n}}\cos\left[\frac{\pi}{n}\left(n-1+\frac{1}{2}\right)k\right].$$

If A consists of correlated values, then most of the DCT coefficients (w_0 and w_k) produced will be zero or small numbers, and only a few are large. The early DCT coefficients (e.g., w_1, w_2) corresponds to low-frequency components of the image information. The low-frequency components usually contain the important image information. The later coefficients (e.g., w_{n-2}, w_{n-1}) contain the less-important (high-frequency components) image information.

Let's do an experiment. Given the set A, where elements of A are correlated numbers. If we apply DCT to a set, it will result in 8 DCT coefficients.

A=[1 2 3 4 5 6 7 8]

WA=[12.7279 -6.4423 0 -0.6735 0 -0.2009 0 -0.0507]

Let us ignore the coefficients with absolute values smaller than one.

WA'=[12.7279 -6.4423 0 0 0 0 0 0]

If we apply the inverse1 DCT transform to W', we can reconstruct the original data set A with a small mean square error (0.4965).

A=[1 2 3 4 5 6 7 8]

A=[1.3407 1.8217 2.7104 3.8716 5.1284 6.2896 7.1783 7.6593]

The energy of A is concentrated by DCT in only two coefficients because the elements in A are correlated.

Here is the Matlab code for this experiment.

```
A   = 1:8;
W   = dct(A);
W_q = W;
W_q(abs(W_q)<1) = 0;
A_q = idct(W_q);
mse = mean(sum((A-A_q).^2))
```

On the other hand, if we apply DCT to a set of uncorrelated numbers, it will result in coefficients with large values. Consider the set B given below. If we apply DCT to B, the total energy (sum of the absolute values of the coefficients) of DCT coefficients is 42.0907.

B =[1 5 -9 -8 7 1 0 9]

WB =[2.1213 -6.0855 7.5688 5.2571 4.2426 -11.8857 -3.9005 1.0293]

Therefore, if you plan to use DCT for data compression, you should first find a good way to represent your data where the elements are correlated. For example, let us naively sort the elements of B and then apply DCT to the sorted set.

B_s = [-9 -8 0 1 1 5 7 9]

WB_s = [2.1213 -16.4520 -2.0719 -3.5681 -0.7071 1.8680 2.3890 0.3323]

In this case, the total energy is 29.5097.

Here is the Matlab code for this experiment.

```
B   = [1 5 -9 -8 7 1 0 9];

W   = dct(B);

sumW = sum(abs(W));

B_s = sort(B);

W_s = dct(B_s);

sumW_s = sum(abs(W_s));
```

One interesting feature of DCT is that the value of n (number of the elements in the data set) plays a critical role in the calculations. Most applications employing the DCT use 8 as the value of n. The table below shows the value of $\frac{(2t+1)f\pi}{2n}$ in degrees for n=8, t=0,..,n-1, and k=0,..,n-1.

	k\t	0	1	2	3	4	5	6	7
low freq. (DC)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1	11.25	33.75	56.25	78.75	101.25	123.75	146.25	168.75
	2	22.50	67.50	112.50	157.50	202.50	247.50	292.50	337.50
	3	33.75	101.25	168.75	236.25	303.75	11.25	78.75	146.25
	4	45.00	135.00	225.00	315.00	45.00	135.00	225.00	315.00
	5	56.25	168.75	281.25	33.75	146.25	258.75	11.25	123.75
	6	67.50	202.50	337.50	112.50	247.50	22.50	157.50	292.50
high freq.	7	78.75	236.25	33.75	191.25	348.75	146.25	303.75	101.25

We us the first row to calculate w_0 and similarly use the second row to calculate w_1, and so on so forth. When we calculate DCT coefficients, we have a set of n input numbers and we have n coefficients. For each DCT coefficients, we have a base frequency f. If we draw the cosine values, it will be very clear how the cosine signal changes with increasing frequency.

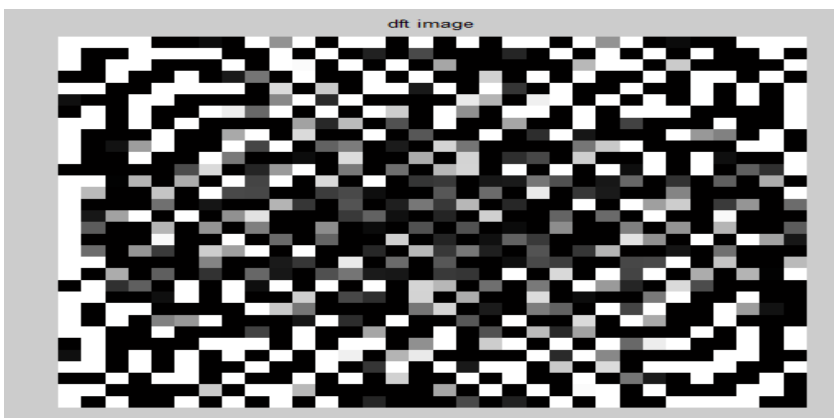
Matlab code:

```
clc;
close all;
clear all;
f=imread('cameraman.tif');
[M N]=size(f);
imshow(f);
title('cameraman');
k=fft2(f);
k=fft2(f,M,N);
figure,imshow(k);
title('dft image');
imwrite(k,'dftimage.tif');
q=imread('dftimage.tif');
p=ifft2(q);
p=ifft2(q,M,N);
figure,imshow(q);
title('idft image');
```

SIMULATION RESULTS

Input image:

DFT image:



IDFT image:

REMOVAL NOISE FROM NOISY SIGNAL

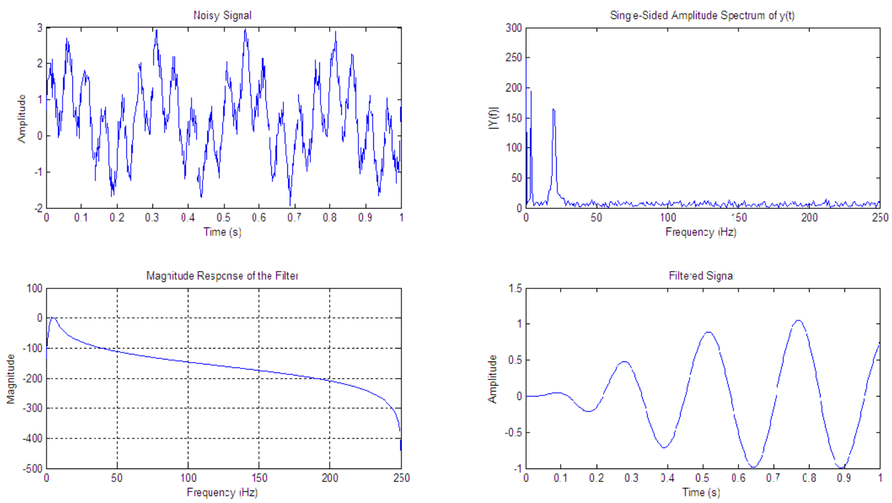
Spectral subtraction is used in this research as a method to remove noise from noisy speech signals in the frequency domain. This method consists of computing the spectrum of the noisy speech using the Fast Fourier Transform (FFT) and subtracting the average magnitude of the noise spec-trum from the noisy speech spectrum. We applied spectral subtraction to the speech signal “Real graph”. A digital audio recorder system embedded in a personal computer was used to sample the speech signal “Real graph” to which we digitally added vacuum cleaner noise. The noise removal algorithm was implemented using Matlab software by storing the noisy speech data into Hanning time-widowed half-overlapped data buffers, computing the corresponding spectrums using the FFT, removing the noise from the noisy speech, and reconstructing the speech back into the time domain using the inverse Fast Fourier Transform (IFFT). The performance of the algorithm was evaluated by calculating the Speech to Noise Ratio (SNR). Frame averaging was introduced as an optional technique that could improve the SNR. Seventeen different configurations with various lengths of the Hanning time windows, various degrees of data buffers overlapping, and various numbers of frames to be averaged were investigated in view of improving the SNR. Results showed that using one-fourth overlapped data buffers with 128 points Hanning windows and no frames averaging leads to the best performance in removing noise from the noisy speech.

Program:

```
clc
close  all;
clear all;
Fs = 500;
f = 20;
n = [1/Fs:1/Fs:1];
x = sin(2*pi*f*n) + sin(2*pi*f*n/5);
% add noise to the signal
y = x + rand(1,length(x));
% plot the noisy signal
subplot(2,2,1); plot(n,y);
title('Noisy Signal');
```

```
xlabel('Time (s)');
ylabel('Amplitude');
%% Spectral analysis of the signal
L = length(y);
NFFT = 2^nextpow2(L);
y_fft = abs(fft(y,NFFT));
% creating frequency axis
freq = Fs/2*linspace(0,1,NFFT/2+1);
% Plot single-sided amplitude spectrum.
subplot(2,2,2);
plot(freq,y_fft(1:NFFT/2+1));
title('Single-Sided Amplitude Spectrum of y(t)');
xlabel('Frequency (Hz)');
ylabel('|Y(f)|');
%% Design Filter and apply on the sequence
o = 5;
wn = [3 7]*2/Fs;
[b,a] = butter(o,wn,'bandpass');
% see frequency response of the filter
[h,w] = freqz(b,a,1024,Fs);
subplot(2,2,3);
plot(w,20*log10(abs(h)));
title('Magnitude Response of the Filter');
xlabel('Frequency (Hz)');
ylabel('Magnitude');grid on;
% Filter the signal
y_filt = filter(b,a,y);
subplot(2,2,4);
plot(n,y_filt);
title('Filtered Signal');
xlabel('Time (s)');
ylabel('Amplitude');
```

Output:



6. VIRTUAL LAB EXPERIMENT:

A FIR filter is a digital filter whose impulse response settles to zero in finite time as opposed to an infinite impulse response filter (IIR), which uses feedback and may respond indefinitely to an input signal. The great thing about FIR filters is that they are inherently stable and can easily be designed to have linear phase. I won't get into the details much further on FIR filters and their pro's and con's as this tutorial focuses more on designing filters fast and efficiently with the aid of Octave.

Typically, in FIR filter design the length of the filter will need to be specified. You can guess and check until the filter matches your expected bandwidth and cutoff requirements, but this could be a long and tedious process. The equation below is an efficient way to compute a reasonable starting length. After trying the calculated N, one can then tweak N or parameters which make up N to meet filter specifications.

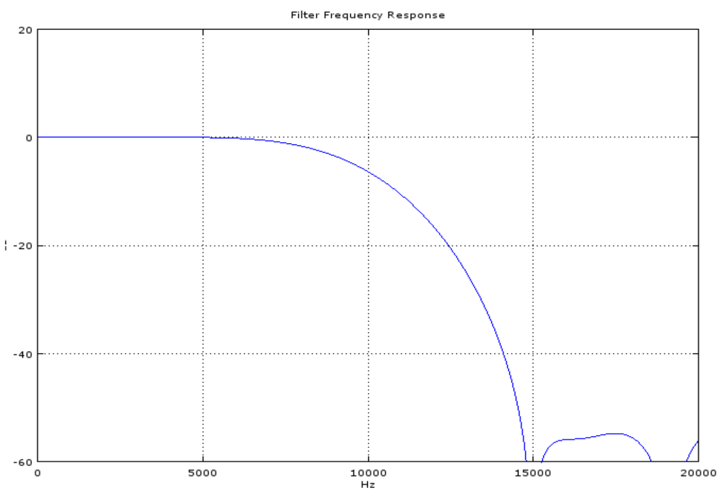
Designing an FIR filter length to be odd length will give the filter an integral delay of (N-1)/2.

Using the Octave/Matlab code below, we can see how to design a lowpass filter with a bandwidth of 10kHz and a cutoff of 15kHz using Octave's built in fir1 function, which is well documented here

<u>Octave Code:</u>

```
close all;
clear all;
clf;
f1 = 10000;
f2 = 15000;
delta_f = f2-f1;
Fs = 192000;
dB  = 40;
```

```
N = dB*Fs/(22*delta_f);

f =  [f1 ]/(Fs/2)
hc = fir1(round(N)-1, f,'low')


figure
plot((-0.5:1/4096:0.5-1/4096)*Fs,20*log10(abs(fftshift(fft(hc,4096)))))
axis([0 20000 -60 20])
title('Filter Frequency Response')
grid on
```



7. SUGGESTED BOOKS:

1. Digital signal processing, principles, algorithms and applications: Johnn G.Proakis, Dimitris G.Monalakis, Pearson Education/PHI 2007
2. Discrete Time Signal Processing –A.V.Oppenheim and R.W.Schaffer,PHI 2009
3. Fundamentals of Digital Signal Processing-Loney Ludeman, John Wiley, 2009

8. WEB SITES (USEFUL LINKS):

1. NPTEL VIDEO LECTURES:

https://nptel.ac.in/courses/117/102/117102060/

2. COURSERA:

https://www.coursera.org/learn/matlab3.

3.MATH WORKS:

https://in.mathworks.com/matlabcentral/fileexchange/58879-digital-signal-processing-lab-exercises4.

4.EDX:

https://www.edx.org/course/discrete-time-signal-processing-4

5. UDEMY:

https://www.udemy.com/course/digital-signal-processing-with-matlab/

9. EXPERT DETAILS

REGIONAL:

1. Dr. Nukala Suryanarayana Murthy B.E,M.S,Ph.D
Professor
Vasavi College of Engineering
nsmurthy58@gmail.com,+914023146003

NATIONAL:

1. Dr. Neelakandan Rajamohan

Assistant Professor

Electrical Engineering **Department**

neelakandan@iitgoa.ac.in ,0832-2490-107

INTERNATIONAL:

2. Vinay Chakravarthy Gogineni
Post doctoral Research fellow

Machine Intelligence Department,

Simula Research Laboratory, Norway

Contact Number:+47 465 65 641

Url:https://scholar.google.com/citations?user=8H5s9vEAAAAJ&hl=en
E-mail address: enwcsiu@polyu.edu.hk

10. **(A) LAB SCHEDULE:** The lab schedule should be planned once in a week. The week wise Scheduled experiment should be completed.

CYCLE 1 (For 30 students per session and 3 students per batch)

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7	week-8
B1, B2	Demo	Exp.1	Exp.2	Exp.10	Exp.9	Exp.7	Exp.8	Lead1
B3, B4	Demo	Exp.2	Exp.10	Exp.9	Exp.8	Exp.1	Exp.3	Lead1
B5, B6	Demo	Exp.10	Exp.9	Exp.8	Exp.1	Exp.2	Exp.7	Lead1
B7, B8	Demo	Exp.9	Exp.8	Exp.1	Exp.3	Exp.10	Exp.2	Lead1
B9, B10	Demo	Exp.8	Exp.1	Exp.2	Exp.7	Exp.3	Exp.10	Lead1

CYCLE 2(For 30 students per session and 3 students per batch)

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**	week-7	week-8
B1, B2	Exp.3	Exp.4	Exp.6	Exp.11	Exp.12	Exp.5	Hobby/lead2	test
B3, B4	Exp.7	Exp.6	Exp.11	Exp.12	Exp.5	Exp.4	Hobby/lead2	test
B5, B6	Exp.3	Exp.11	Exp.12	Exp.5	Exp.4	Exp.6	Hobby/lead2	test
B7, B8	Exp.7	Exp.12	Exp.5	Exp.4	Exp.6	Exp.11	Hobby/lead2	test
B9, B10	Exp.9	Exp.5	Exp.4	Exp.6	Exp.11	Exp.12	Hobby/lead2	test

(B) VIVA SCHEDULE: The viva schedule should be planned prior starting to the lab experiment.

ROUND - 1

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**
B1,B2,B3, B4	viva					
B5,B6,B7,B8		viva				
B9,B10,B11,B12			viva			
B13,B14,B15,B16				viva		
B17,B18,B19,B20					viva	
						Viva

ROUND - 2

Batches	week-1	week-2	week-3	week-4	week-5
SG1	viva				
SG2		viva			
SG3			viva		
SG4				viva	
SG5					viva

*SG: Selected Group with a maximum of 6 or 12 students

(C) SCHEME OF EVALUATION

LAB EXTERNAL

S no.	Write-up (by Internal examiner)	Final evaluation (Internal Examiner)	Viva (External Examiner)
1	Aim Equipment needed MATLAB code Theoretical-Calculations Expected graph	Based on observation, how the student is writing the code, usage of software And based on correctness of the practical graph to the expected graph and results.	Based on understanding of Experiment and theoretical questions in the related subject.
	Marks: 20	**Marks: 40**	**Marks: 15**
Total Marks:20+40+15=75 Marks			

LAB INTERNAL

Day to Day Evaluation ------ 15 Marks					**Internal Exam ---10M Marks**		
Uniform	Observation & Record	Performance of experiment	Result	Viva Voce	Write-up	Connections & Result	Viva Voce
Marks: 3	**Marks:3**	**Marks:3**	**Marks: 3**	**Marks: 3**	**Marks:4**	**Marks :3**	**Marks :3**
Total Marks:15+10=25 Marks							

12. MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D:

The lab course is designed in such a way that it meets the requirements of research and development as well as consultancy projects. Also the Proposals of Project/R&D/Consultancy are as follows:

Proposal 1: Project Design & Execution

Proposal 2: R& D Level Project Design & Execution

Proposal 3: Consultancy Task / Project Design & Development

PROPOSAL FOR R & D ACTIVITY:

1. An exact paper from a National/International journal in this entitled area/subject/area (IEEE Format) AND/OR
2. An article/white paper from a magazine /journal/weekly/any periodical in the entitled subject AND/OR
3. An Advanced technology development/ proposal/article publication from any source of Information

PROPOSALS 2:

Abstract

We can capture an input signal, observe its waveform and variation with time on an oscilloscope, but further processing of the signal is not feasible with it. When we need to digitize signals into samples and observe the waveform through plotting, we need a computer along with software

PROPOSAL FOR PROJECT ACTIVITY:

1. A Proposal of a hobby/mini/proto/general/model/proto type project with extended abstract, Block Diagram/Circuit/Flow diagram and clear references may be presented and executed.

Hobby Project:

Artifacts Removal in ECG Signal Using MATLAB

Theory:

The word *artifact* is similar to *artificial* in the sense that it is often used to indicate something that is not natural (i.e. man-made). In electrocardiography, an ECG artifact is used to indicate something that is not "heart-made." These include (but are not limited to) electrical interference by outside sources, electrical noise from elsewhere in the body, poor contact, and machine malfunction. Artifacts are extremely common, and knowledge of them is necessary to prevent misinterpretation of a heart's rhythm.

Pacing spikes

These are seen in someone whose implanted pacemaker is firing.

The sharp, thin spike seen in figure x-x is an electrical signal produced by an artificial pacemaker. The wide QRS complex that follows it represents the ventricles depolarizing. We say that the "(artificial) pacemaker *captures"* when it is able to successfully depolarize its intended target. If a pacing spike is not followed by its intended response, we say that it has *failed to capture*.

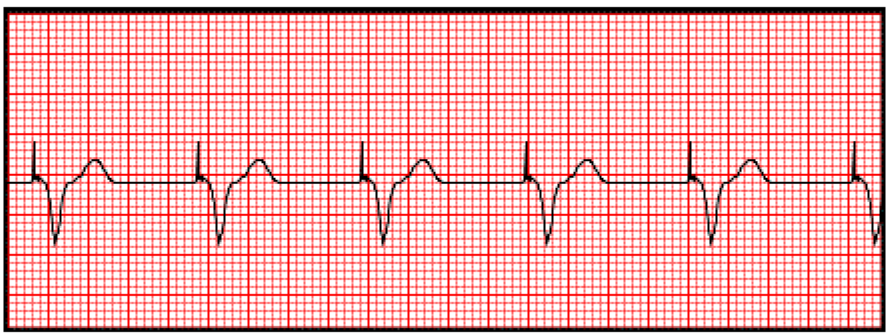


Figure 12-1 : Artificial pacemaker spikes

The wide QRS suggests that the pacemaker was implanted in the ventricles.

Reversed leads / misplaced electrodes

Electrode/lead placement is very important. If one were to accidentally confuse the red and white lead cables (i.e. place the white one where the red one should go, vice versa), he might get an ECG that looks like figure 12-2. In this ECG, we can make out a normal sinus rhythm with all of the waves upside-down. When this happens, you are essentially viewing the rhythm in a completely different lead.

One must also make sure that the lead wires are actually plugged into the machine. If your talkative patient shows asystole, you should suspect this. Many machines are "smart" in that they can sense common errors of this nature, but many such errors aren't always readily apparent.

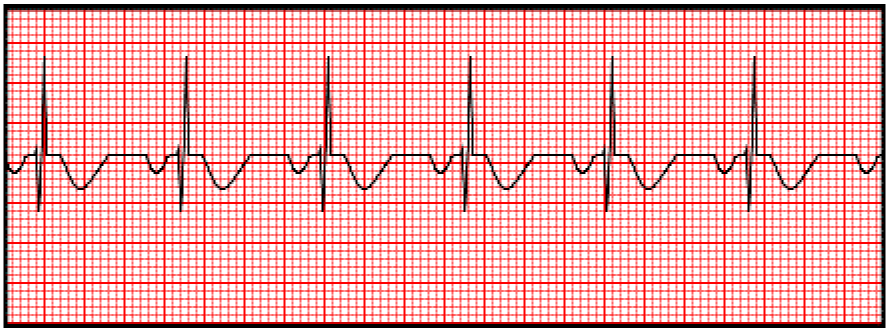


Figure 12-2 : reversed leads

AC interference

Alternating current (AC) describes the type of electricity that we get from the wall. In the United States, the electricity "changes direction" 60 times per second (i.e. 60 hertz). (Many places in Europe use 50 Hz AC electricity.) When an ECG machine is poorly grounded or not equipped to filter out this interference, you can get a thick looking ECG line (as shown in figure 12-3). If one were to look at this ECG line closely, he would see 60 up-and-down wave pattern in a given second (25 squares).

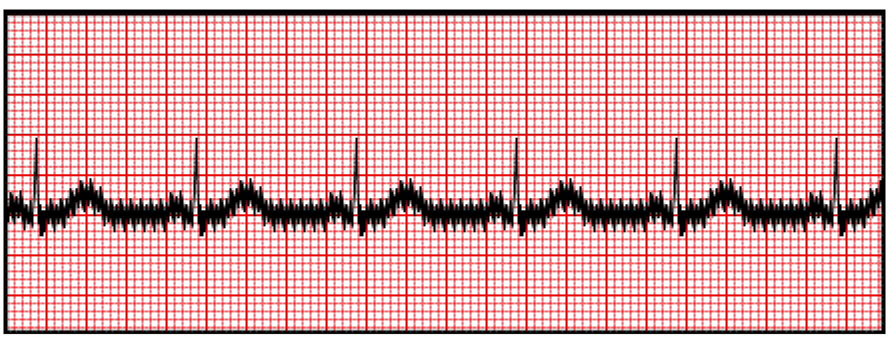


Figure 12-3 : 60 Hz AC interference

Muscle tremor / noise

The heart is not the only thing in the body that produces measurable electricity. When your skeletal muscles undergo tremors, the ECG is bombarded with seemingly random activity. The term *noise* does not refer to sound but rather to electrical interference.

Low amplitude muscle tremor noise can mimic the baseline seen in atrial fibrillation. Muscle tremors are often a lot more subtle than that shown in figure 12-4.

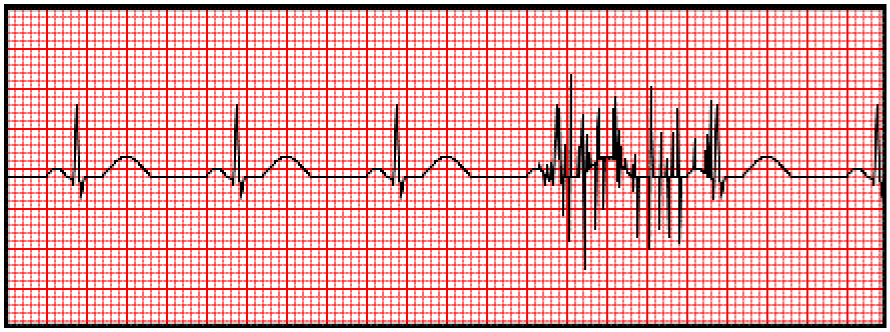


Figure 12-4 : Muscle tremors

Wandering baseline

In wandering baseline, the isoelectric line changes position. One possible cause is the cables moving during the reading. Patient movement, dirty lead wires/electrodes, loose electrodes, and a variety of other things can cause this as well.

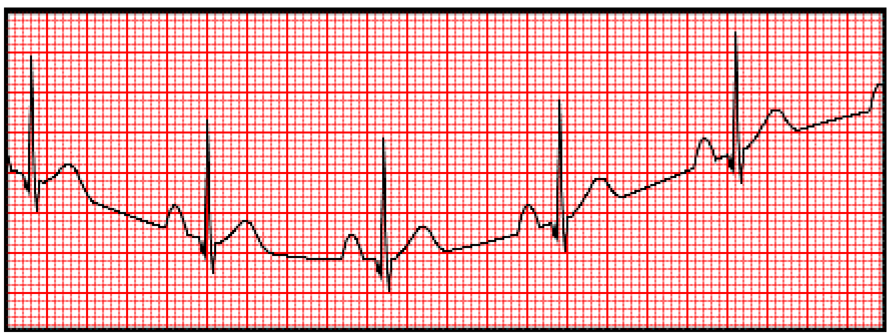


Figure 12-5 : Wandering baseline artifact

Absolute heart block

Absolute heart block (or 4th degree heart block) results from over-exposure to imported-liquor advertisements in magazines. QRS complexes are wide and bottle-shaped and show no relationship with the P wave. It occurs very rarely, and even then, only in fictional settings. This should not be confused with the real arrhythmia *complete heart block*.

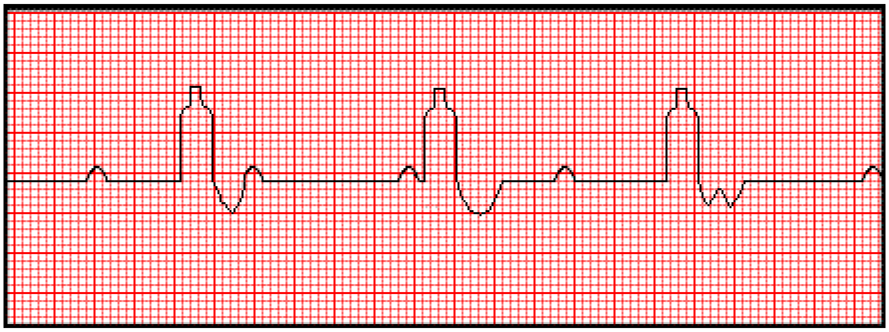
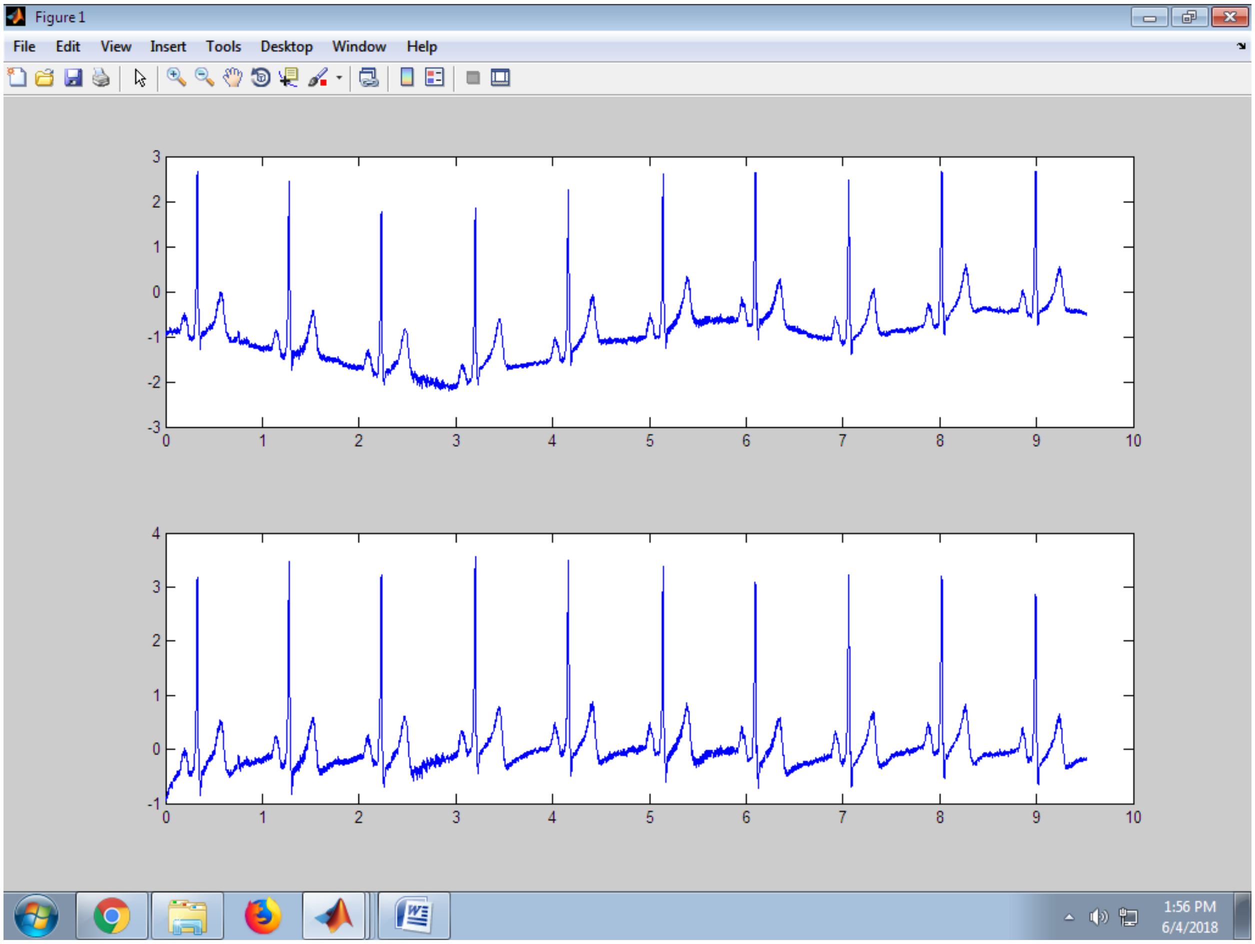


Figure 12-6 : Absolute heart block

CODE:

```
% MATLAB PROGRAM ecg_lfn.m
clear all              % clears all active variables
close all

ecg = load('ecg_lfn.dat');
L=length(ecg);
fs = 1000; %sampling rate = 1000 Hz
 %slen = length(ecg);
t=[1:L]/fs;
%figure
%plot(t,ecg)
%axis tight;
%xlabel('Time in seconds');
%ylabel('ECG');
b=[1,-1]
a=[1,-0.995]
figure,
t1=zplane(b,a,(1/fs))
[h,f]=freqz(b,a,L,fs);
%subplot(211)
%plot(f,abs(h))
[ph,f]=phasez(b,a,L,fs)
%subplot(212)
%plot(f,ph)
out=filter(b,a,ecg);
subplot(211)
plot(t,ecg);
subplot(212)
plot(t,out);
E_ref=sum(out.^2);
noise=ecg-out;
E_noise=sum(noise.^2);
SNR=10*log10(E_ref/E_noise)
```

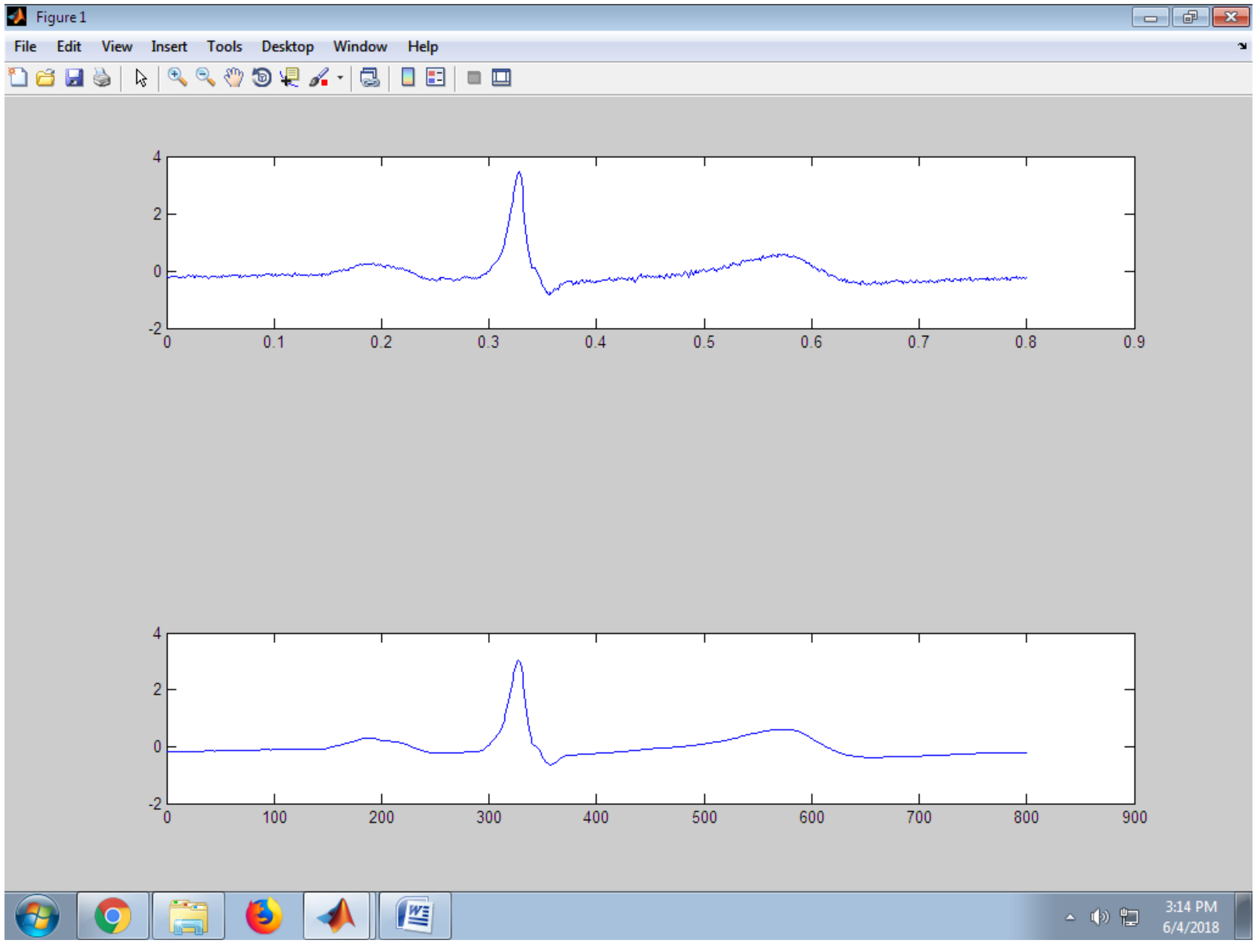



```
% MATLAB PROGRAM ecg_lfn.m
clear all              % clears all active variables
close all

ecg = load('ecg_lfn.dat');
L=length(ecg);
fs = 1000; %sampling rate = 1000 Hz

%slen = length(ecg);
t=[1:L]/fs;
%figure
%plot(t,ecg)
%axis tight;
%xlabel('Time in seconds');
%ylabel('ECG');
b=[1,-1]
a=[1,-0.995]
figure,
t1=zplane(b,a,(1/fs))
```

```
[h,f]=freqz(b,a,L,fs);
%subplot(211)
%plot(f,abs(h))
[ph,f]=phasez(b,a,L,fs)
%subplot(212)
%plot(f,ph)
out=filter(b,a,ecg);
%subplot(211)
%plot(t,ecg);
%subplot(212)
%plot(t,out);
temp_start=950;
L_temp=801;
temp=out(temp_start:(temp_start+L_temp-1));
t2=(1:L_temp)/fs
subplot(311)
plot(t2,temp);
n=floor(L_temp/2);
x1=[zeros(n,1);out;zeros(n,1)]
for i=1:length(out)
    prod=temp.*x1(i:i+L_temp-1);
    cross_corr(i)=sum(prod)/(norm(temp)*norm(x1(i:i+L_temp-1)));
end
%subplot(312)
%plot(t,cross_corr);
noisy_ecg=cross_corr;
threshold=0.9;
idx=find(cross_corr > threshold);
for i=1:length(idx)-1
    if ((idx(i)-n)>=1)&&((idx(i)+n)<=length(out))
        sync_avg1(i,:)=out(idx(i)-n:idx(i)+n);
    end
end
sync_avg=mean(sync_avg1);
subplot(313)
plot(sync_avg);
E_ref=sum(sync_avg.^2);
noise=sync_avg-(temp)';
E_noise=sum(noise.^2);
SNR=10*log10(E_ref/E_noise)
```

SNR =

14.5169



<u>PROPOSAL FOR CONSULTANCY</u>

Proposed Equipment for usage:
A program/machine/product of utility may be proposed to develop for in house usage/Industrial requirements may be useful for any outside agency that can be marketable in order to generate revenue through consultancy.

Design and Simulation of (OFDM) Signaling

Abstract:
A MATLAB program has been written to investigate Orthogonal Frequency Division Multiplexing (OFDM) communication systems. This program is valuable for future researchers simulating systems that are too theoretically complex to analyze. Single-carrier QAM and multi-carrier OFDM are compared to demonstrate the strength of OFDM in multipath channels. Two graphical user interface demonstrations show some of the basic concepts of OFDM.

Introduction

The Electrical Engineering Senior Capstone Project is intended to give each student experience in completing a sophisticated design project that spans most of the senior year. Planning, management of time, allocation of responsibility, documentation, and presentation of the results are integrated with the technical design task. The students work with one or two faculty advisors who have expertise in the project research area. The student is fully responsible for the design project, with the advisor(s) acting as guide and mentor. Each student is expected to work an eight-hour lab period each week from October through May.

A common problem found in high-speed communication is inter-symbol interference (ISI). ISI occurs when a transmission interferes with itself and the receiver cannot decode the transmission correctly. For example, in a wireless communication system such as that shown in Figure 1, the same transmission is sent in all directions.

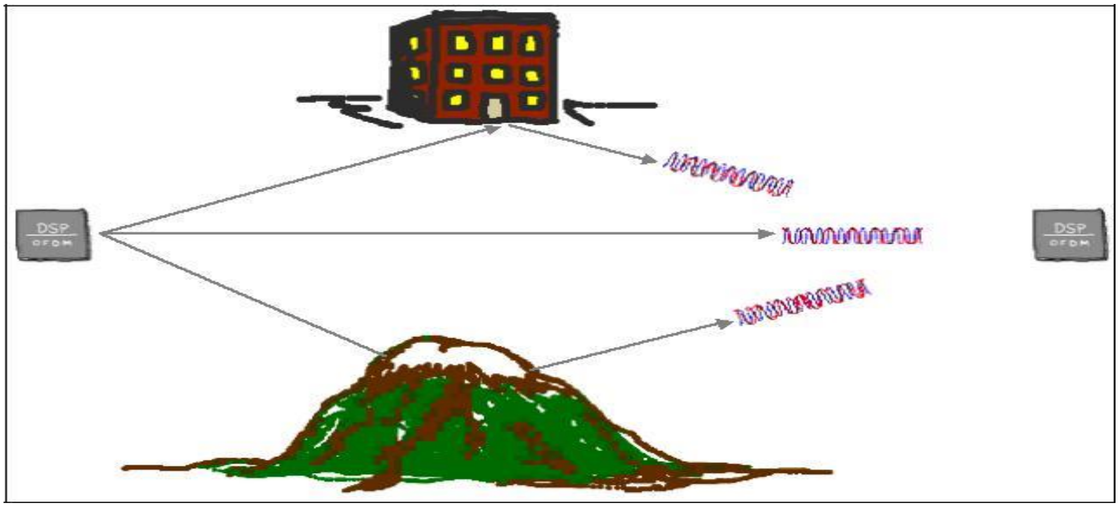


Figure 1: Multipath Demonstration

Theory

This project will focus on Orthogonal Frequency Division Multiplexing (OFDM) research and simulation. OFDM is especially suitable for high-speed communication due to its resistance to ISI. As communication systems increase their information transfer speed, the time for each transmission necessarily becomes shorter. Since the delay time caused by multipath remains constant, ISI becomes a limitation in high-data-rate communication [1]. OFDM avoids this problem by sending many low speed transmissions simultaneously. For example, Figure 2 shows two ways to transmit the same four pieces of binary data.

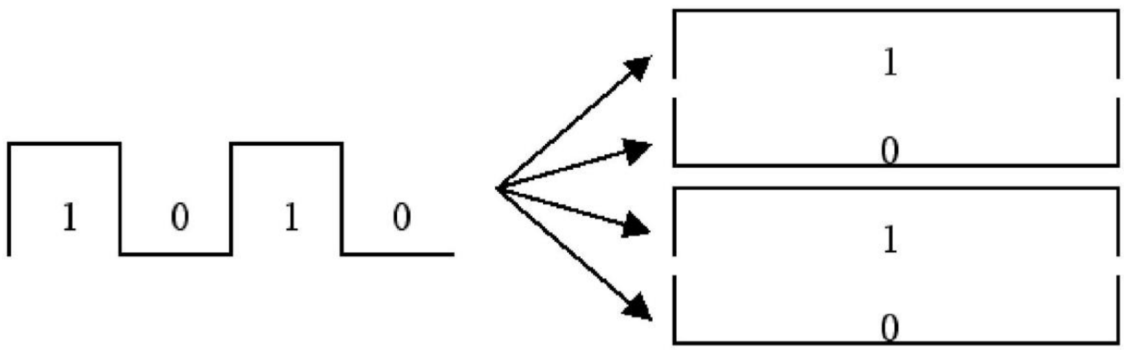


Figure 2: Traditional vs. OFDM Communication

Suppose that this transmission takes four seconds. Then, each piece of data in the left picture has a duration of one second. On the other hand, OFDM would send the four pieces simultaneously as shown on the right. In this case, each piece of data has a duration of four seconds. This longer duration leads to fewer problems with ISI. Another reason to consider OFDM is low-complexity implementation for high-speed systems compared to traditional single carrier techniques.

Significance

With the rapid growth of digital communication in recent years, the need for high-speed data transmission has increased. New multicarrier modulation techniques such as OFDM are currently being implemented to keep up with the demand for more communication capacity. Multicarrier communication systems "were first conceived and implemented in the 1960s, but it was not until their all-digital implementation with the FFT that their attractive features were unraveled and sparked widespread interest for adoption in various single-user and multiple access (MA) communication standards" . The processing power of modern digital signal processors has increased to a point where OFDM has become feasible and economical. Examining the patents, journal articles, and books available on OFDM, it is clear that this technique will have an impact on the future of communication. See the references section (starting on page 21) for a condensed bibliography and list of patents related to this topic. Since many communication systems being developed use OFDM, it is a worthwhile research topic. Some examples of current applications using OFDM include GSTN (General Switched Telephone Network), Cellular radio, DSL & ADSL modems, DAB (Digital Audio Broadcasting) radio, DVB-T (Terrestrial Digital Video Broadcasting), HDTV broadcasting, HYPERLAN/2 (High Performance Local Area Network standard), and the wireless networking standard IEEE

802.11.

Simulation Design

This project consists of research and simulation of an OFDM communication system.

Figure 3 shows a simplified flowchart of the MATLAB simulation code.

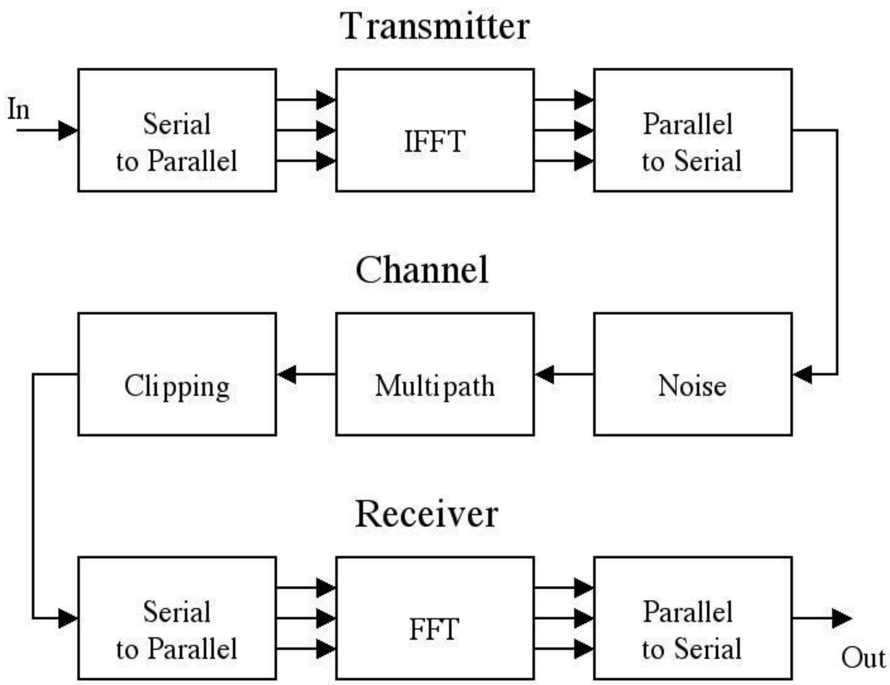


Figure 3: OFDM Simulation Flowchart

The transmitter first converts the input data from a serial stream to parallel sets. Each set of data contains one symbol, S_i, for each subcarrier. For example, a set of four data would be [S_0 S_1 S_2 S_3]. Before performing the Inverse Fast Fourier Transform (IFFT), this example data set is arranged on the horizontal axis in the frequency domain as shown in Figure 4.

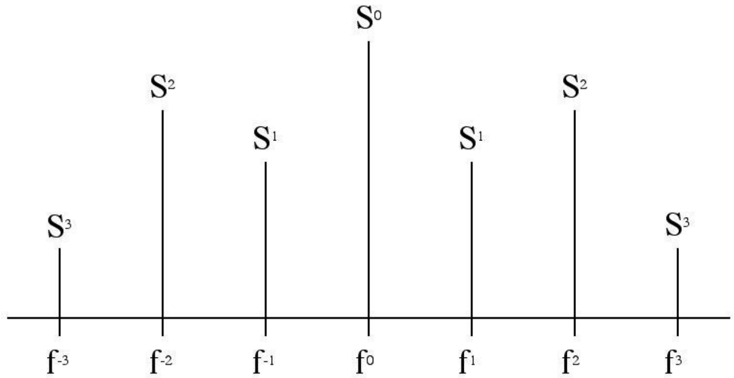


Figure 4: Frequency Domain Distribution of Symbols

This symmetrical arrangement about the vertical axis is necessary for using the IFFT to manipulate this data. An inverse Fourier transform converts the frequency domain data set into samples of the corresponding time domain representation of this data. Specifically, the IFFT is useful for OFDM because it generates samples of a waveform with frequency components satisfying orthogonality conditions. Then, the parallel to serial block creates the OFDM signal by sequentially outputting the time domain samples.

The channel simulation allows examination of common wireless channel characteristics such as noise, multipath, and clipping [5]. By adding random data to the transmitted signal, simple noise is simulated. Multipath simulation involves adding attenuated and delayed copies of the transmitted signal to the original. This simulates the problem in wireless communication when the signal propagates on many paths. For example, a receiver may see a signal via a direct path as well as a path that bounces off a building. Finally, clipping simulates the problem of amplifier saturation. This addresses a practical implementation problem in OFDM where the peak to average power ratio is high.

The receiver performs the inverse of the transmitter. First, the OFDM data are split from a serial stream into parallel sets. The Fast Fourier Transform (FFT) converts the time domain samples back into a frequency domain representation. The magnitudes of the frequency components correspond to the original data. Finally, the parallel to serial block converts this parallel data into a serial stream to recover the original input data.

Results

The MATLAB simulation accepts inputs of text or audio files as well as binary, sinusoidal, or random data. It then generates the corresponding OFDM transmission, simulates a channel, attempts to recover the input data, and performs an analysis to determine the transmission error rate. In order to compare OFDM to a traditional single carrier communication system, a 16-QAM simulation can be performed. These simulations are dynamic, allowing the user to set parameters determining the characteristics of the communication system. Two simple demonstrations of OFDM communication were developed with a graphical user interface (GUI) following the style of MATLAB toolbox demonstrations. These allow someone to quickly learn the basic concepts of OFDM communication.

The first demonstration, basicgui (or basicgui_win), introduces the process of creating an OFDM symbol. It shows a simple example of using the Fourier transform to send binary data on four frequencies. The following screenshots show the demo sequence with explanations in the text box.

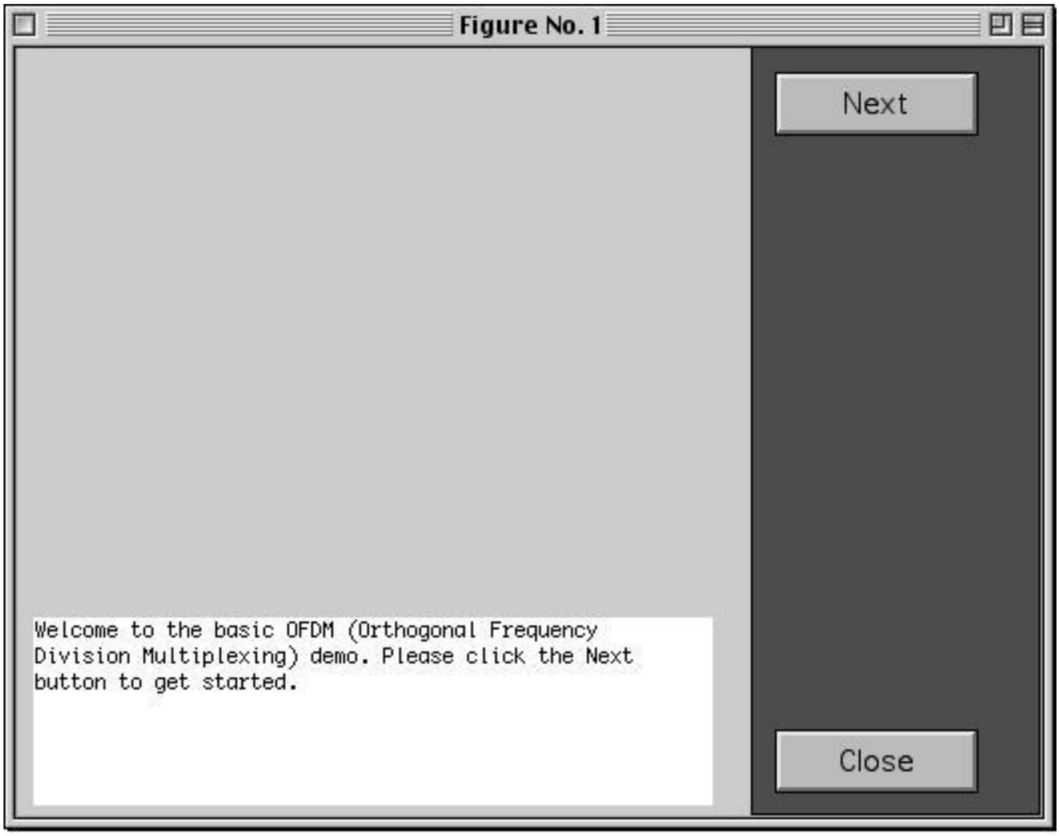


Figure No. 1
Next
Welcome to the basic OFDM (Orthogonal Frequency Division Multiplexing) demo. Please click the Next button to get started.
Close

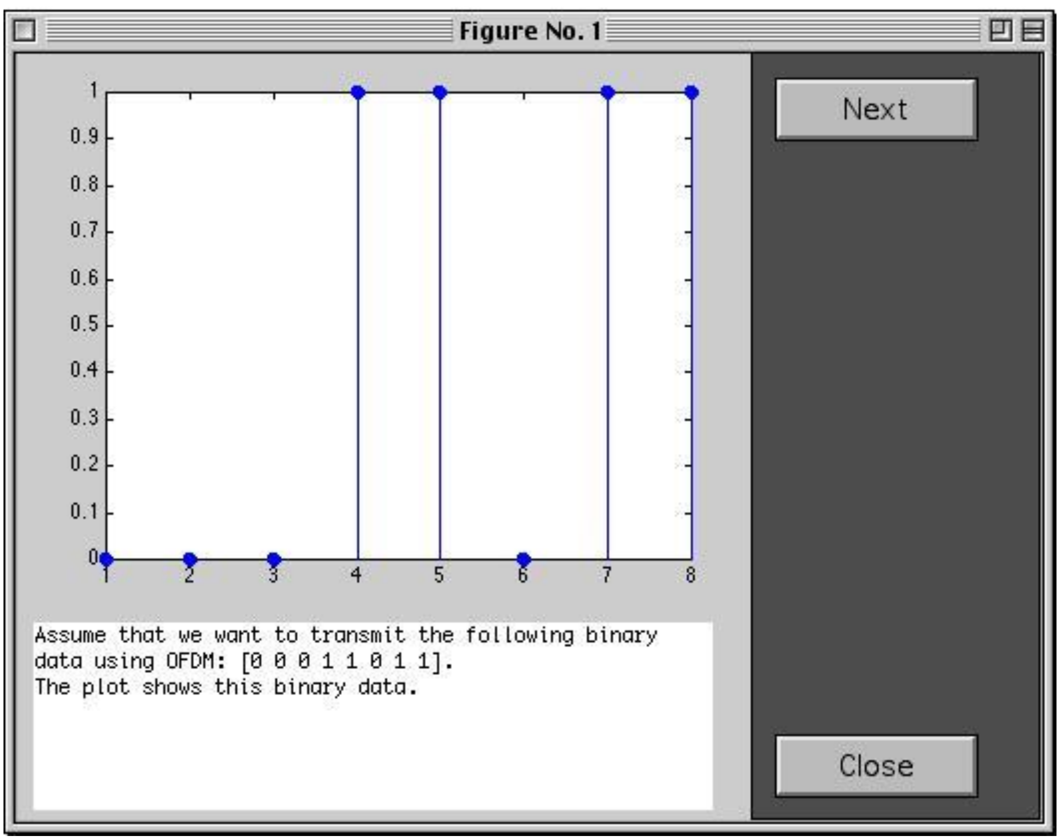


Figure No. 1
Next
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8
Assume that we want to transmit the following binary data using OFDM: [0 0 0 1 1 0 1 1].
The plot shows this binary data.
Close

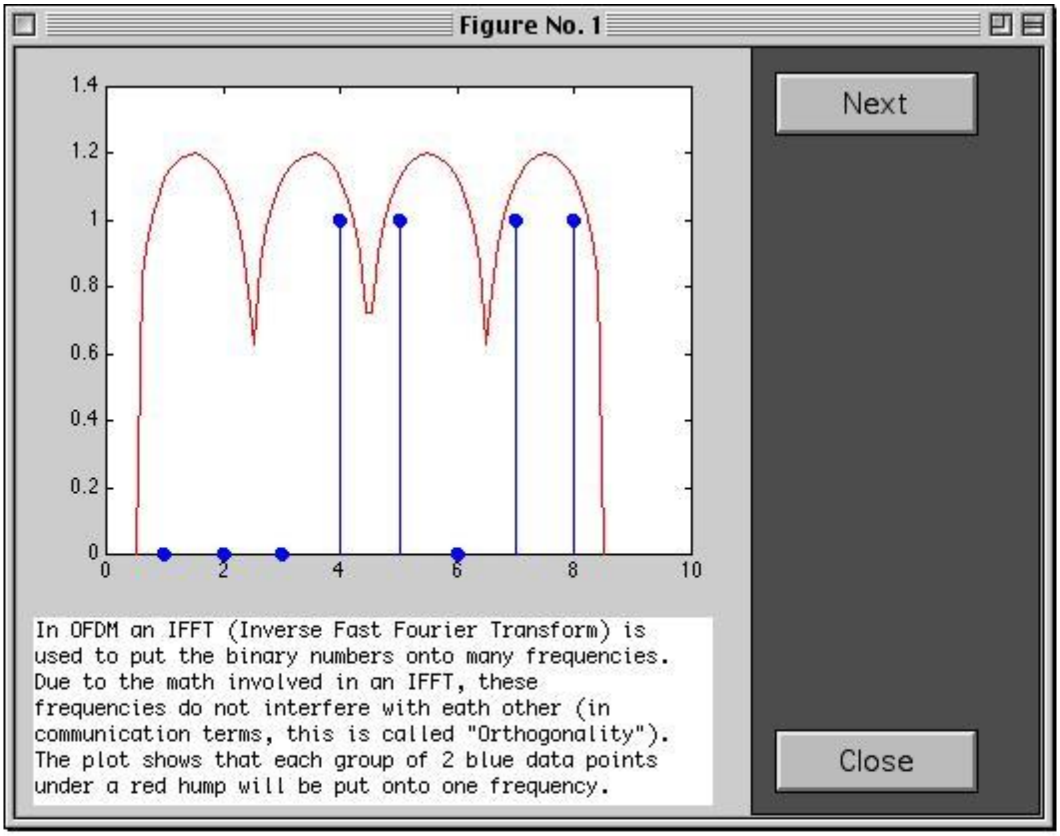


Figure No. 1
Next
Close
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
In OFDM an IFFT (Inverse Fast Fourier Transform) is used to put the binary numbers onto many frequencies. Due to the math involved in an IFFT, these frequencies do not interfere with eath other (in communication terms, this is called "Orthogonality"). The plot shows that each group of 2 blue data points under a red hump will be put onto one frequency.

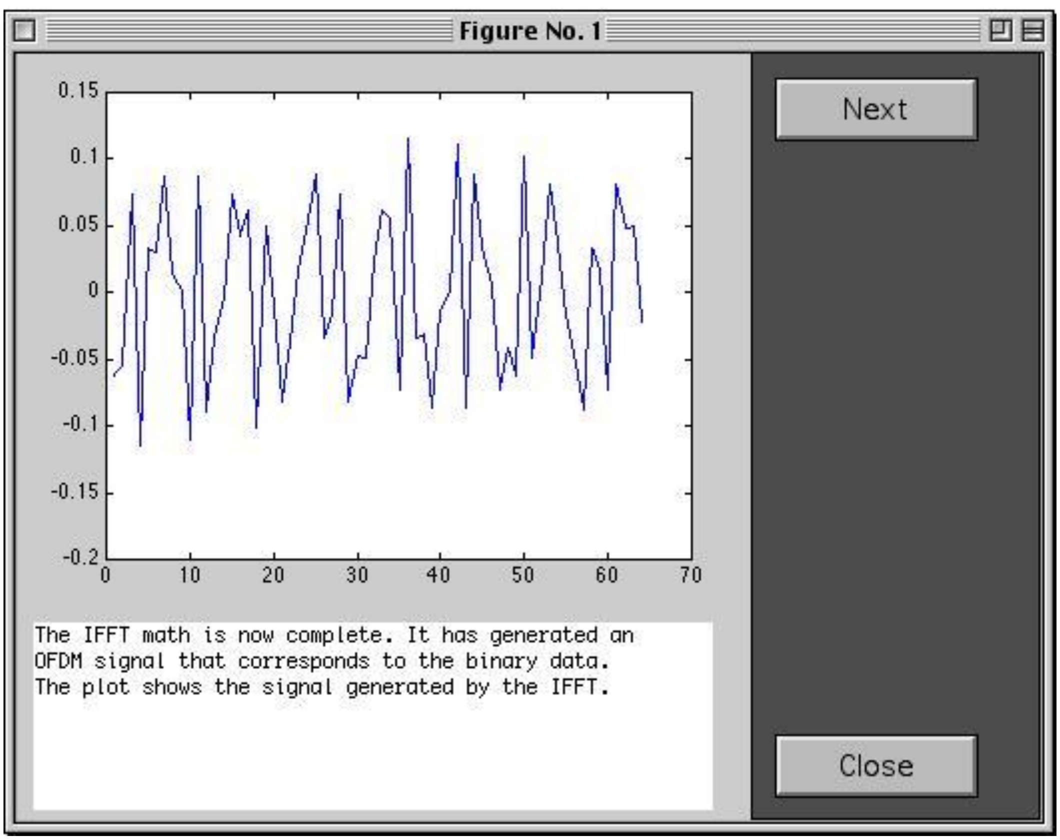


Figure No. 1
Next
Close
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0
10
20
30
40
50
60
70
The IFFT math is now complete. It has generated an OFDM signal that corresponds to the binary data. The plot shows the signal generated by the IFFT.

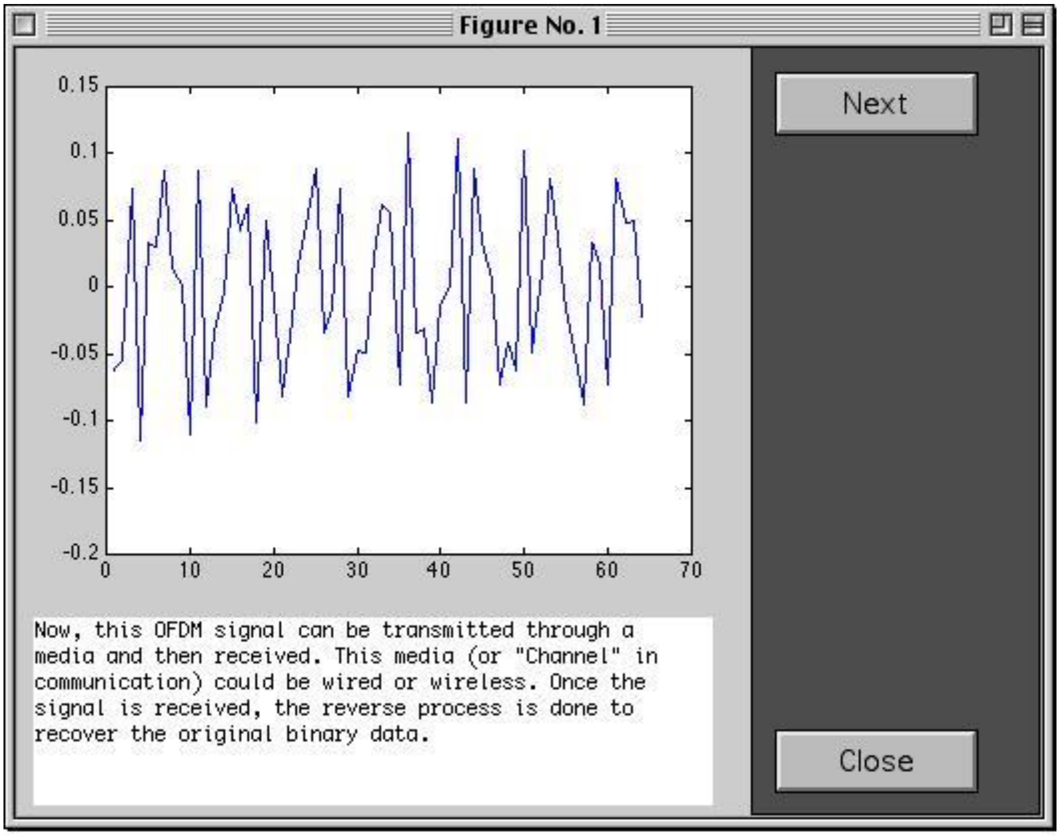


Figure No. 1
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0 10 20 30 40 50 60 70
Next
Close
Now, this OFDM signal can be transmitted through a media and then received. This media (or "Channel" in communication) could be wired or wireless. Once the signal is received, the reverse process is done to recover the original binary data.

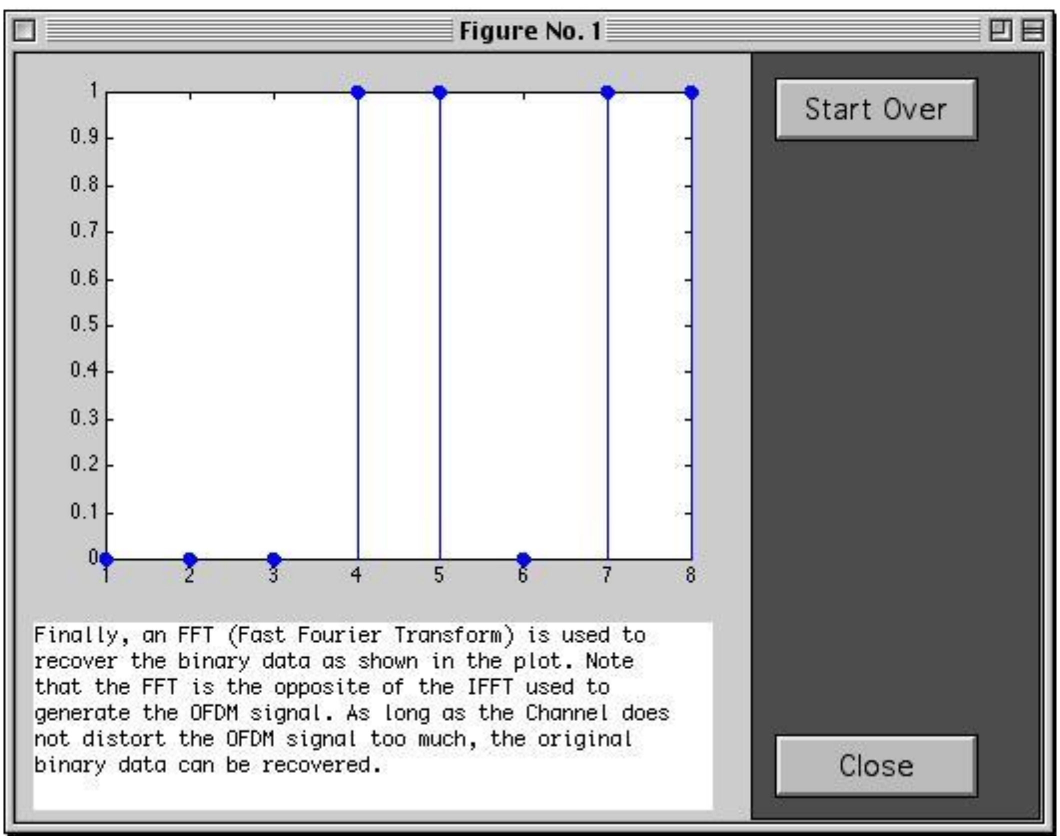
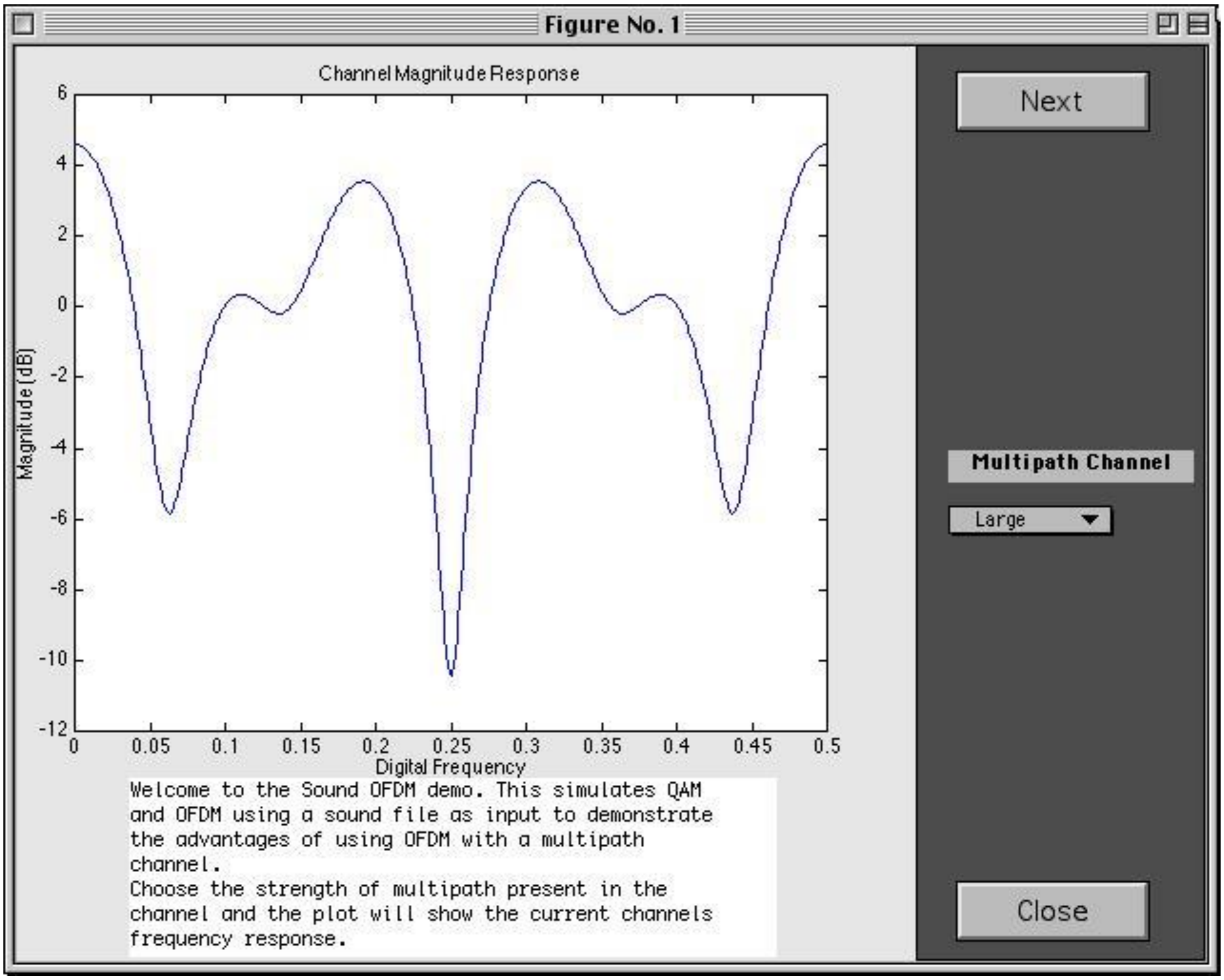


Figure No. 1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8
Start Over
Close
Finally, an FFT (Fast Fourier Transform) is used to recover the binary data as shown in the plot. Note that the FFT is the opposite of the IFFT used to generate the OFDM signal. As long as the Channel does not distort the OFDM signal too much, the original binary data can be recovered.

The second demonstration, soundgui (or soundgui_win), gives a more technical example. It compares OFDM to 16-QAM in a multipath channel. The user can choose no, small, or large amount of multipath. The following screenshots show the demo sequence with explanations in the text box.



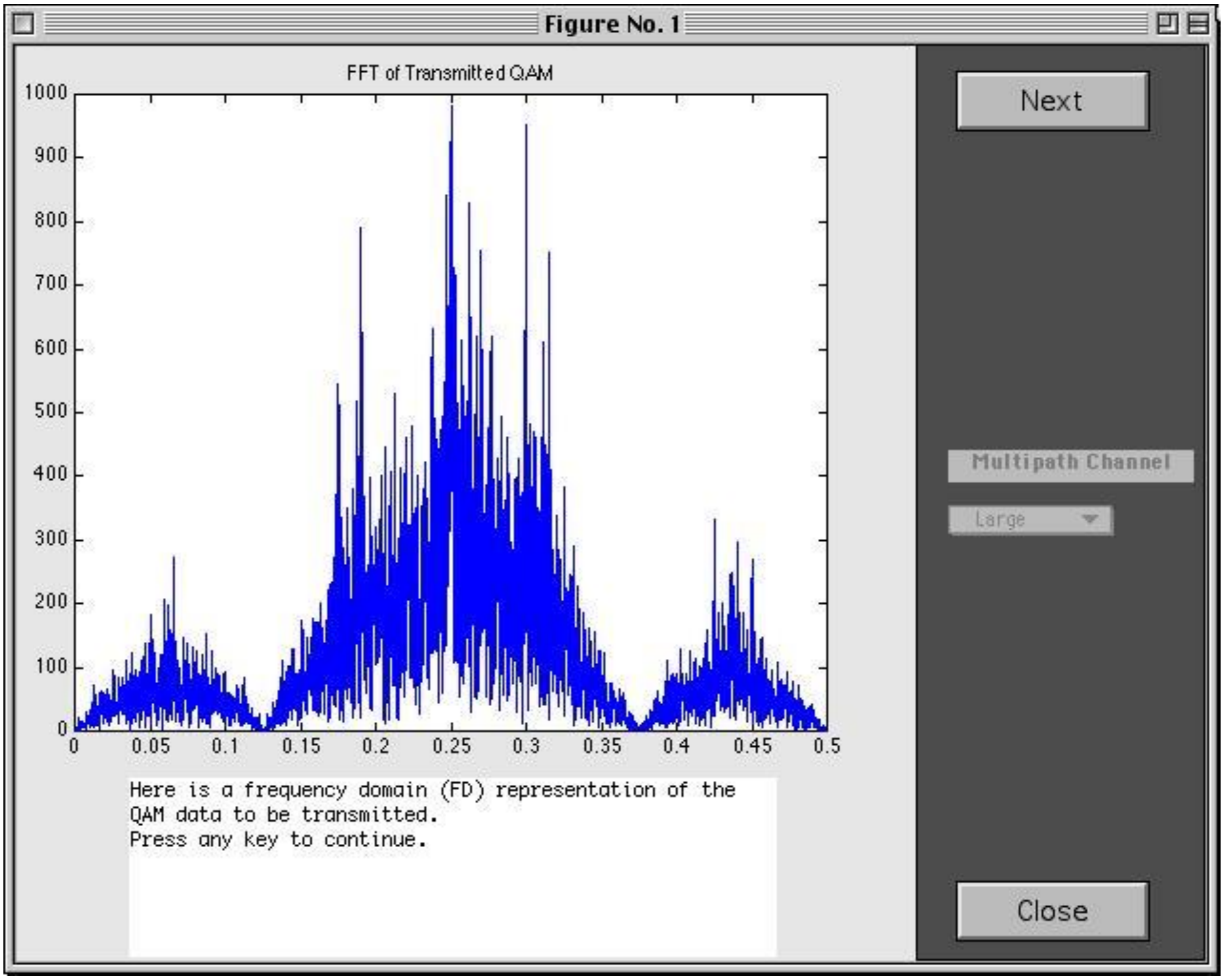


Figure No. 1
FFT of Transmitted QAM
1000
900
800
700
600
500
400
300
200
100
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Here is a frequency domain (FD) representation of the
QAM data to be transmitted.
Press any key to continue.
Next
Multipath Channel
Large
Close

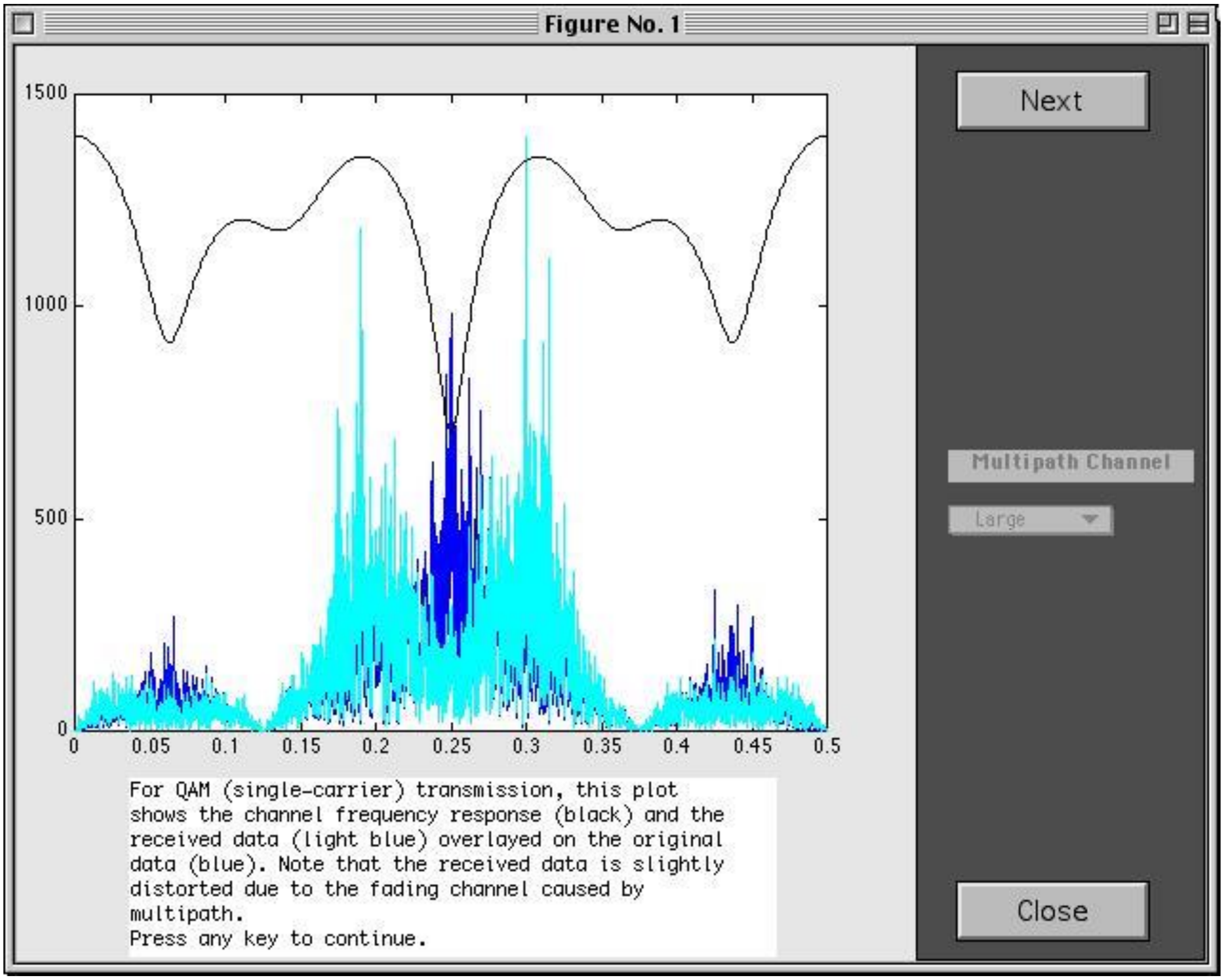


Figure No. 1
Next
Multipath Channel
Large
Close
1500
1000
500
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
For QAM (single-carrier) transmission, this plot shows the channel frequency response (black) and the received data (light blue) overlayed on the original data (blue). Note that the received data is slightly distorted due to the fading channel caused by multipath.
Press any key to continue.

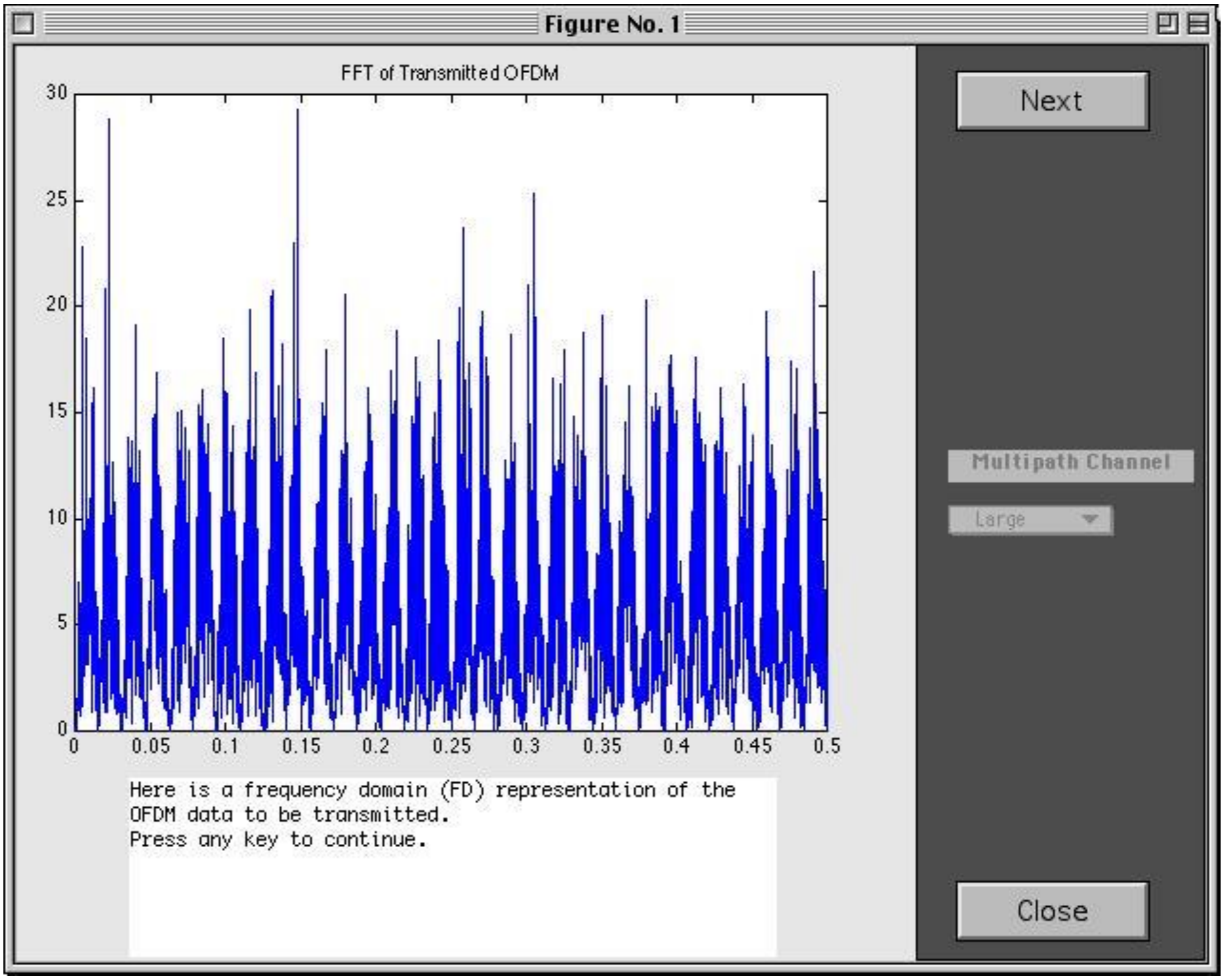


Figure No. 1
FFT of Transmitted OFDM
30
25
20
15
10
5
0
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5
Here is a frequency domain (FD) representation of the
OFDM data to be transmitted.
Press any key to continue.
Next
Multipath Channel
Large
Close

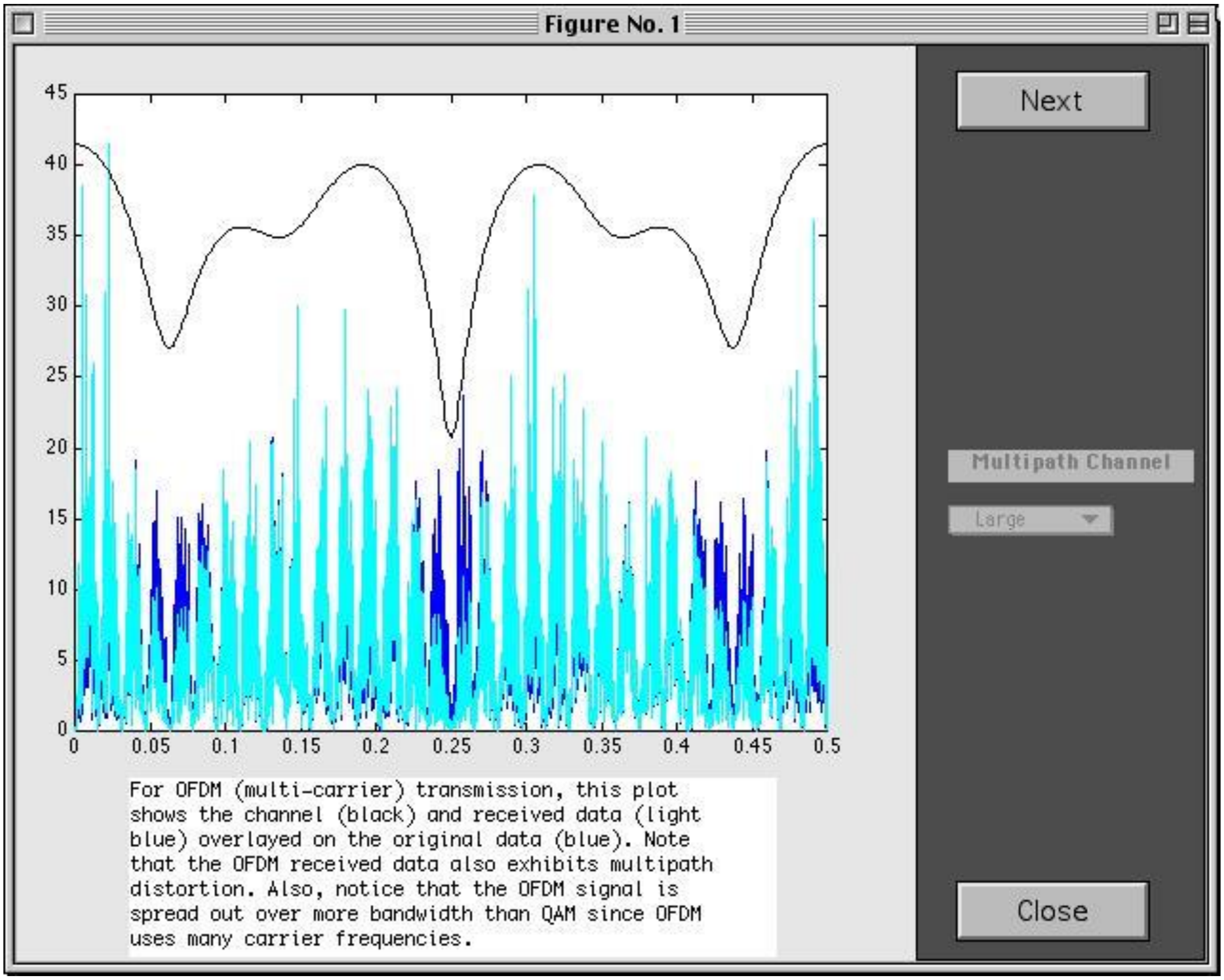
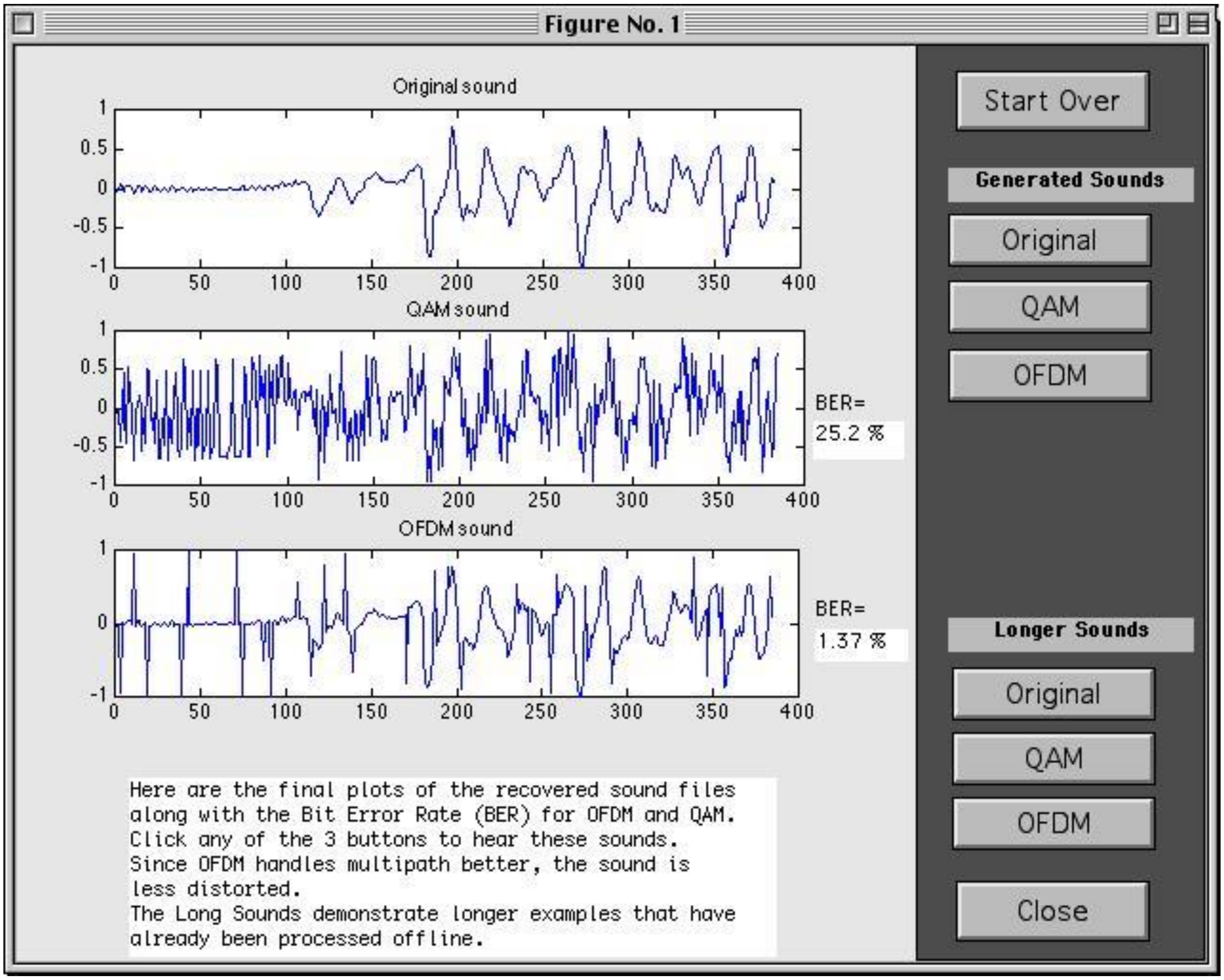


Figure No. 1
Next
Multipath Channel
Large
Close
45
40
35
30
25
20
15
10
5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
For OFDM (multi-carrier) transmission, this plot shows the channel (black) and received data (light blue) overlayed on the original data (blue). Note that the OFDM received data also exhibits multipath distortion. Also, notice that the OFDM signal is spread out over more bandwidth than QAM since OFDM uses many carrier frequencies.



The two GUI demonstrations utilize the complete simulation code, but not all of its capabilities. By modifying the setup.m m-file, users can adjust parameters such as the fft_size, num_carriers, input types, and channel characteristics. It also allows detailed analysis of the communication system. Plots showing OFDM input and output, 16-QAM input and output, and the received 16-QAM signal constellation are generated. See Figures 5, 6, and 7 for examples of these plots.

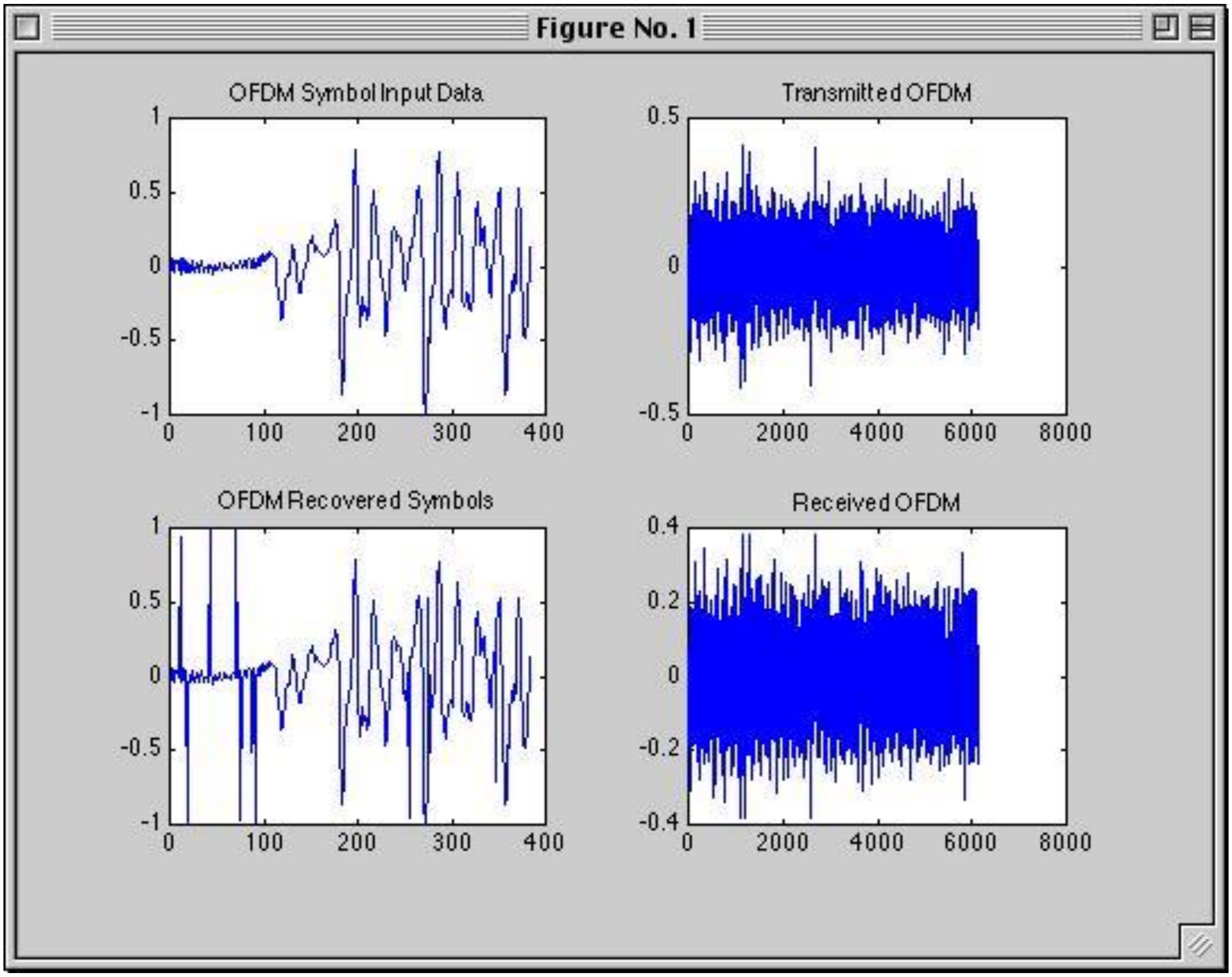


Figure 5: OFDM Input and Output

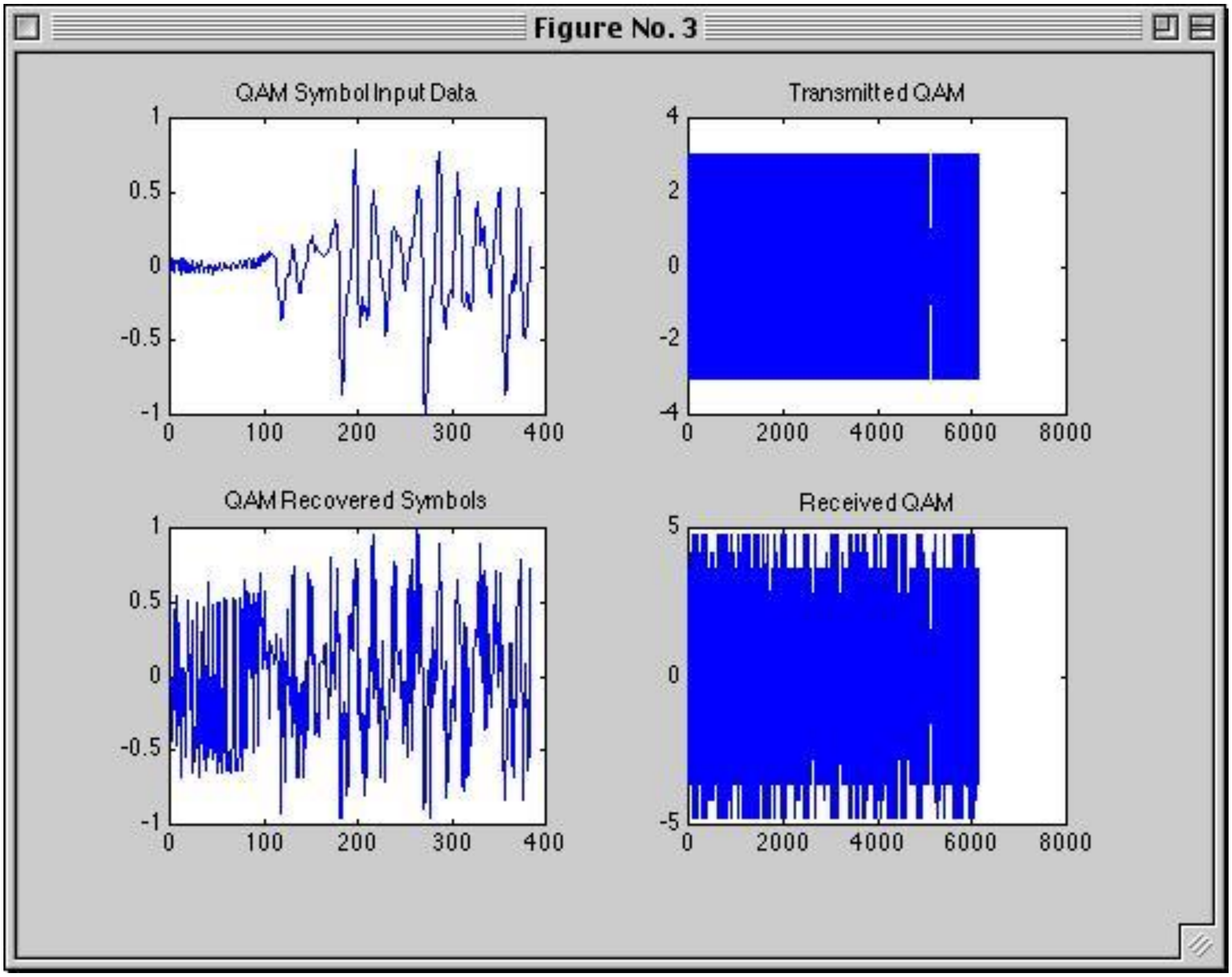


Figure 6: 16-QAM Input and Output

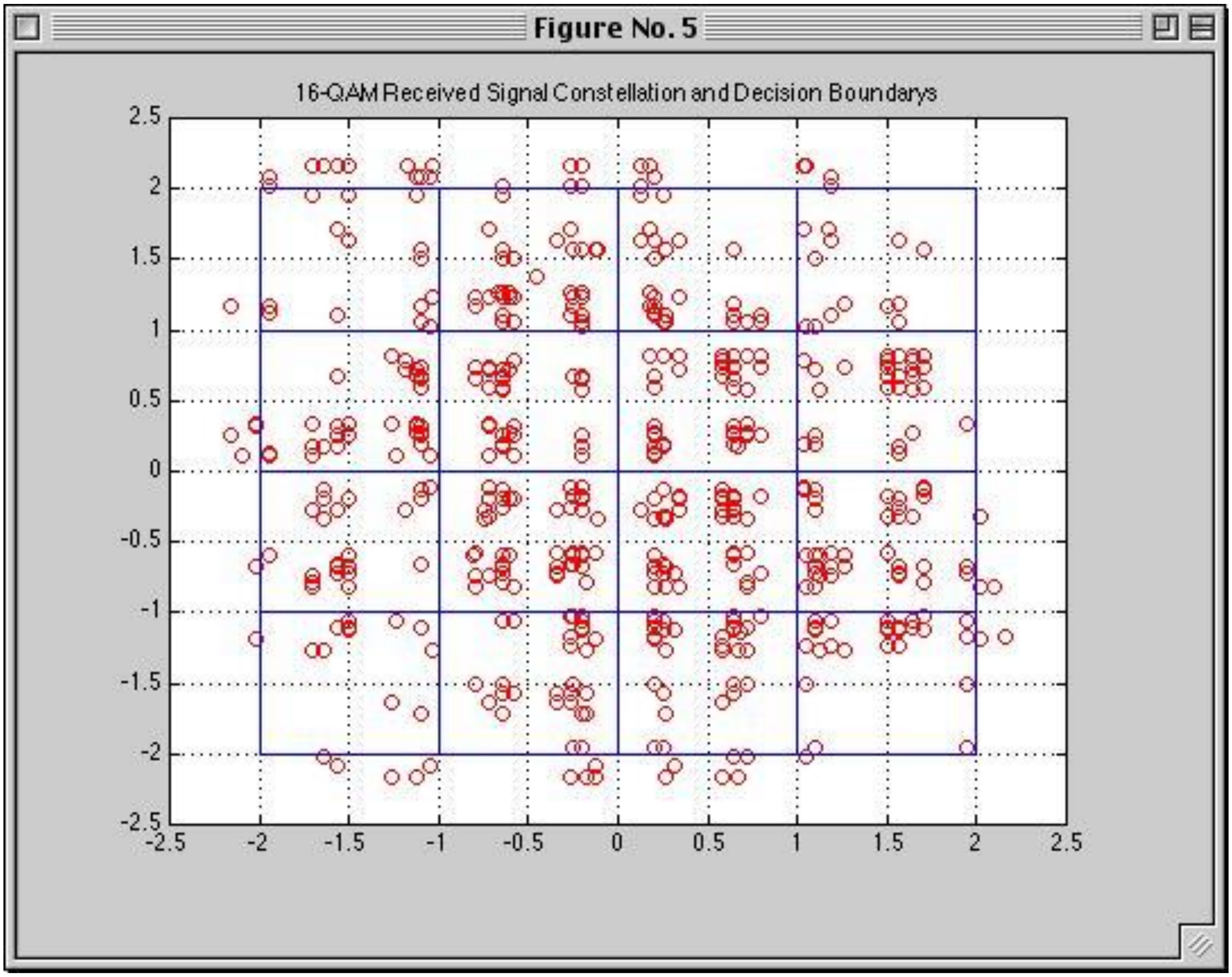


Figure 7: Received 16-QAM Signal Constellation

Depending on the input type chosen, appropriate output files are created. This enhances the numerical error analysis by showing how the errors degrade the data being transmitted. For one test, the preamble of the US constitution was transmitted. Figure 8 shows the results.

The Original Data	*OFDM transmission* *Bit Error Rate = 0.0699%* *Binary Errors = 4*	*16-QAM transmission* *Bit Error Rate = 23.0%* *Binary Errors = 1,315*
IN CONGRESS, July 4, 1776.	IN CONGRESS, July 4, 1776.	JO$ìè__BÜSÉ\4õtl8$x<4tz*). ___x u$¥n!Æ)m/$rTïucú1±°¥yo_$ø _$¥
The unanimous Declaration of the thirteen united States of America,	The unanimous Declaration of the thirteen united States of America,	xu$¥xyq¥uen$¥n)tud4£§q¥ur Tø_$ í□%q©cël___Xun$ □n$¥xu$ìü$q□ï $ø_$□tm!Æ$µuen4r\4 □t4□•cü_%r
When in the Course of human events, it becomes necessary for	When in the Course of human events, it becomes necessary for	Tæ%cïr¢ë± □$□o!dø_%_0µo º5$¥ _¥yr¢ü_5e$¥xu$ □ø_9tycë¨4
one people to dissolve the political bands which have connected them	one people to dissolve the political baods which have connected thel	□°Æ$rT□Xycò4 □qµe$ □ü_.%c§ud 4¥xum_6Ytx4±Æ/$xuql4±Æ$ 4¥
with another, and to assume among	with another, and to assume among	_± □ ¢§m%$± □ /_'_¥xu$□ ø&Uq□ Tø _$¥xu$µa±¥x<4¥xu_2ïp±±°¥ u$±
the powers of the earth, the separate and equal station to which	the powers of the earth, the separate and equal station to which	Æ$4µp¥a¨4 □§q¥yo_$¥ _ □Xycò4¥
the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the	the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the	xu$ù1 □bTø_$ü!¥tq•$±Æ$4ø___!¥t q•+bTó__4µn4yt\|5$¥xum,4±d ¥ucï n44±•r†µc§4¥ _¥xu$ø □n)o_2Tø__- !Æ+Yn$4±•p¥iq•rT¥xq¥4¥xu x$ □ò
separation.	separation.	$l44¥ucú1±•$¥xu$ □ë¥rïrT□Xycò 4□m0µl_4xum$¥ _¥xu$ □ïp±±°¥y o_.___U$□ _44¥xurï$¥q¥txrT¥
We hold these truths to be self-evident, that all men are created	We hold these truÙ hs to be self- evident, that all meo are created	_□•$□ïl6
equal, that they are endowed by	equal, that they are endowed by	%uidun4<4¥xq¥4±¨<4 □ %n$±±•$ □ °•a¥ud_%p¥a¨<4¥xq¥4¥xux$ ±±•$
their Creator with certain unalienable Rights, that among	their Creator with certain unalienable Rights, that	µn$ &Ud4 □□$¥xuiqdì°•a¥

these are Life, Liberty and the pursuit of Happiness.	among these are Life, Liberty and the pursuit of Happiness.	!d □Y tx4□ïq¥q©n$¥n!¨9en!¢¨5__© gXtr\ 4¥xq¥4± □/_'_¥xurï$±±•$ù9fe,4ù9b •q¥x$±Æ$4¥xu$ □¥q□§it4ø_$ôq □ □□n%r¢^_f

Figure 8: Text Example Comparing OFDM to 16-QAM

OFDM transmission had a very low bit error rate of 0.0699% so only four errors were caused by the multipath channel. 16-QAM incurred a 23.0% bit error rate. Since a character is represented by eight bits, every character had two bits in error on average. This resulted in unintelligible received text.

A second test using an audio file produced similar results. The difference is that users can see and hear the degradation caused by binary errors. Figure 9 shows plots of the audio files.

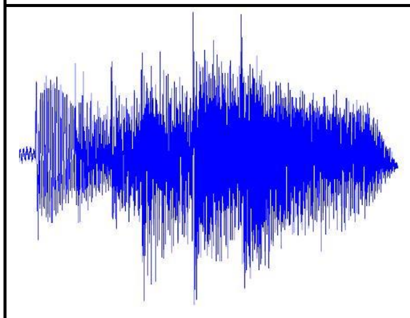
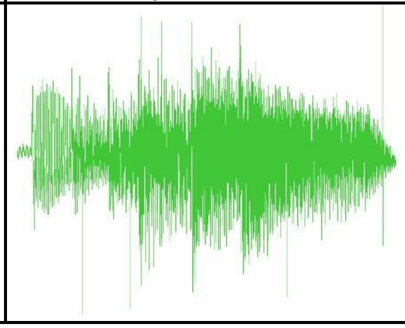
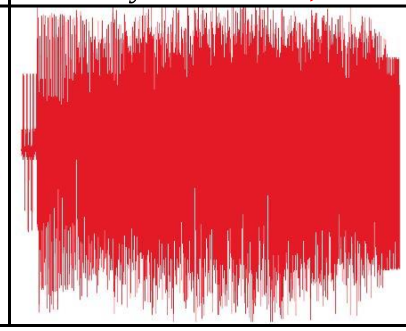
The Original Sound	*OFDM transmission* *Bit Error Rate = 0.01%* *Binary Errors = 17*	*16-QAM transmission* *Bit Error Rate = 21.2%* *Binary Errors = 35,957*
		

Figure 9: Audio Example Comparing OFDM to 16-QAM

In this case, the original sound is a guitar plucking a chord. The OFDM sound contains audible "clicks" due to bit errors and the waveform is similar to that of the original sound. The 16-QAM sound's waveform does not resemble the original and listening to the 16-QAM sound confirms this. The original guitar chord is barely discernable underneath loud static noise.

Conclusion

This MATLAB simulation proves that OFDM is better suited to a multipath channel than a single carrier transmission technique such as 16-QAM. This program is available on the Bradley University Electrical Engineering Department web page at http://cegt201.bradley.edu/projects/proj2001/ofdmabsh/.

Future research may be based on this project. These extensions may include channel phase shift detection and correction, error correction by coding, adaptive transmission, peak to average power ratio considerations, and DSP implementation.

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L. Van Nee, Richard, and Ramjee Prasad. *OFDM for Wireless Multimedia Communications*. Boston: Artech House, 2000.

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P. Bahai, Ahmad R. S., and Burton R. Saltzberg. *Multi-Carrier Digital Comunications:Theory and Applications of OFDM*. New York: Kluwer Academic/Plenum Publishers, 1999.

Q. Lawrey, Eric. OFDM Wireless Technology. 11 May 2000. 7 Nov. 000. http://www.eng.jcu.edu.au/eric/thesis/Thesis.htm

FUNDED/ UNFUNDED PROPOSALS:

The proposal for Two Weeks Embedded Systems Faculty Development Programme (FDP) under AICTE grants is applied and waiting for its approval.

OBJECTIVE:

The proposals for AICTE grants like UGC grants, DST CPRI and other funding agencies by giving Title and abstract/objective OR Self Funded program proposals may be submitted for Management approvals.

Proposal for Seminar Grant:

TITLE: Seminar on Hardware Design Of DSP Systems

OBJECTIVE: This seminar is intended to bring down the awareness among students and staff in order to study the hardware design of DSP systems.

13. PROPOSALS (WEEK WISE INDUSTRIAL VISITS) (IN HOUSE OR OUTSIDE VISIT)/TRAINING PROGRAMMES:

TABLE 1: INDUSTRIAL VISITS

As of now no industrial visits is proposed.

S. No	Type of industry	Nature of industry	Date of visit	No. of students participated	Year/branch	Remarks
1	**Dsp Group,Inc**	TeakDSPCore, D6000 Family ICs	**20-1-2015**	**90**	**III-II ECE**	
2	**DRS Technologies**	ICs like Cheetah PMC	**25-2-15**	**90**	**III-II ECE**	

TABLE 2: INDUSTRIAL TRAINING (Shadow Engineering) (Career Visit Approval)

Three day training on Custom IC design using 45 nm technologies is proposed at CDAC, Hyderabad.

S.No	Name of the Course	Nature of industry	Duration of Training	Authority	Date of Training/Certificate No.	Remarks

GUIDELINES FOR SHADOW ENGINEERING (VIP)

INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM):

OBJECTIVES OF SHADOW ENGINEERING:

1. The program which uplifts the knowledge of the students related to laboratories.
2. To improve the industry-college interactions.
3. To create industry like environment for all the students in order to make future assignments.
4. This program leads to matrixing with the students.

14. CALIBRATION/INSTALLATION AND TESTING:

CALIBRATION: Aim of this concept is to check,

i. Whether all the equipment is functioning correctly as per the standards
ii. To bring correctness in the errors of instrument or equipment
iii. To rectify the errors if any

INSTALLATION: Aim of this concept is to make and maintain installation procedure for a new equipment or already existing equipment.

TESTING: Aim of this concept is to test the equipment after installation whether it meets the existing standards.

Case 1: Calibration of Equipment

S.No	Type of equipment	Certificate No	Certificate issued by	Date of calibration	Date of calibration due	Remarks

Procedure for Installation:

Mat lab Installation:

STEPS**:** Installation of MATLAB Software for window XP/VISTA / Windows 7/8
Get administrator privileges for the system on which you plan to install MATLAB.
Use WinRAR to extract RAR file

Step1: Start the installer for Windows, double-clicking on setup.exe

Step 2: Choose to Install Without Using the Internet
When it starts, the installer displays the following dialog box. Select the Install without using the Internet option and Click OK to proceed with installation.

Step 3: Review the License Agreement
Review the software licensing agreement and, if you agree to its terms, click Yes.

Step 4: Enter the File Installation Key
Enter your File Installation Key and Click OK.

Step 5: Choose the Installation Type
In the Installation Type dialog box, specify whether you want to perform a Custom Installation and click next.

Step 6: Specify the Installation Folder Specify the name of the folder where you want to install MathWorks products. Accept the default installation folder or click Browse to select a different one. If the folder doesn’t exist, the installer creates it.

Step 7: Specify Products to Install (Custom Only)
Leave it by default and continue.
Step 8: Specify the Location of the License File.
Enter the full path of your License File in the text box (or drag and drop the file) and Click Next.
Step 9: Specify Installation Options (Custom Only)
After selecting installation options, click next to proceed with the installation.
Step 10: Confirm Your Choices and Begin Copying Files
Before it begins copying files to your hard disk, the installer displays a summary of your installation choices. To change a setting, click back. To proceed with the Installation, click Install. As it copies files to your hard drive, the installer displays a status dialog box to show the progress of the installation.
Step 11: Complete the Installation.

Case 3: Testing of Equipment

15. MAINTAINANCE AND TROUBLESHOOTING:

(A)TROUBLE SHOOTING SCHEDULES:

(A)Maintenance:

Maintenance and trouble shooting of equipment in a laboratory must follow the following guidelines:

Maintenance Schedules:

(1) Preventive Maintenance Schedules of lab will be decided by lab in charge along with concerned HOD. The details of schedule should be recorded in the following template of format.

S. No.	Name of the Equipment	Date of Maintenance	Type of Activity	Remarks
1	DSP kit		Checking of working	

(2) Maintenance Reports duly signed by in charges as well as HODs and duly approved by Principal periodically.

(B) TROUBLE SHOOTING SCHEDULES:

A proposal is to be made from each lab branch wise. The proposal should carry following details related to specific equipment in lab.

S. No., Equipment Name , Type of Problem (Too much Noise, Abnormal Sound, Corrupt Software, Anti Virus Problem, Missing of Display, CRT not working, Motor is not giving signal, Digital display is not working, Break of tools, Misalignment of machine elements, PLC is not properly working), Expected Reasons (Bearing failure, Improper alignment of machine centre, Missing of vibration pads etc)

Trouble shooting exercises should be properly recorded in a separate format as mentioned below:

S. No	Date of recording activity	Equipment Name	Type of Trouble	Remedial Activity	Remarks

1		TMS320C6713 Processor kit	Led not glowing	Changing that LED.	

16. ASSESSMENT AND ACCREDITATION PROCESDURE AS PER NABL

Accreditation is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to carry out the tasks. It provides the feedback to laboratories as to whether they are performing according to technical competence as per guidelines of NABL (National Accreditation Board for Testing and Calibration Laboratories)

The laboratory should carry out the following important tasks towards getting ready for accreditation from NABL.

1. Preparation of methodology in each experiment
2. Preparation of Standard Operating procedure for each equipment
3. Preparation of Laboratory Manual as per the guidelines specified by Combined Lab Team(CLT) headed by Principal/HOD/Dean/incharge
4. Ensure Effective environmental conditions (temperature, humidity,storage and placement) in the laboratories by implementing proper housekeeping and cleaning of the equipments from dust, dirt etc.
5. Ensure Calibration of instruments/equipment(Only NABL accredited authorized laboratories provide calibration.
6. All the details of Calibration should be included in the format specified exclusively for calibration procedure.
7. Ensure proper implementation of all the documents, formats to be included in the lab manual.
8. Impart training for all the technicians working in labs about the importance of documentation, log sheets, operating procedure of the lab.
9. Incorporate Internal Lab audits for effective functioning of the laboratories. Audits may be once in a month or 3 months or at the end of the semester. The audit schedule will be decided by the Chairman and Principal of the CLT team.
10. Auditors should submit the detailed report of each lab duly signed to the Principal.
11. Each lab should maintain all the bills/invoices of each instrument or equipment in a separate file.
12. All the stock registers either consumable or non consumable should be updated whenever any purchases of consumables or equipment takes place.
13. All the safety precautions are properly displayed in front of each lab.
14. All the Lead experiments should be maintained separately in a record /record in a separate folder.
15. Based on Pre Assessment report submitted by auditor, corrective actions should be carried out by each lab in charge and that must be forwarded to concerned HOD and Principal.

DIGITAL SIGNAL PROCESSING LABORATORY

17. OBJECTIVES AND RELEVANCE
18. SCOPE
19. PREREQUISITES
20. SYLLABUS AS PER JNTUH
21. LEAD EXPERIMENT
22. VIRTUAL LAB EXPERIMENT
23. SUGGESTED BOOKS
24. WEBSITES (USEFUL LINKS)
25. EXPERT DETAILS
26. (A)LAB SCHEDULE
    (B)VIVA SCHEDULE
    (C)SCHEME OF EVALUATION
27. PROJECT/PRODUCT/PAPER BASED LEARNING
28. MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D PROPOSALS
29. GUIDELINES FOR SHADOW ENGINEERING AND INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM)
30. ACTIVITIES IN LIFT PROGRAM
31. MAINTAINANCE AND TROUBLESHOOTING
32. ASSESSMENT AND ACCREDITATION PROCESDURE AS PER NABL

2. OBJECTIVE AND RELEVANCE:

- To emphasize the teaching of key DSP concepts , such as overview of discrete time signal and systems in time domain, and frequency domain, sampling and reconstruction of analog signals, signal and systems representation in complex frequency domain, solution of differential equations using z transform, computation of Fourier transform and its efficient implementation, Discrete Fourier transform and Fast Fourier transform, Structure for the implementation of digital filters, FIR Filter design and IIR Filter Design
- To provide an understanding of how to design signal processing systems and Process data in a software simulation like using MATLAB.
- Digital Signal Processing (DSP) can be described as the processing of signals using digital techniques or digital computers. A signal is a piece of information in binary or digital form. Digital Signal processing techniques improve signal quality or extract important information by removing unwanted part of the signal.

2. SCOPE:

1. The lab helps the students in designing and simulation of various DSP based circuits. The lab is equipped with MATLAB software.
2. The goal of DSP is usually to measure, filter and/or compress continuous real-world analog signals. But to deal with real life analog signals from our environment, it is necessary to convert them to digital form, and vice-versa. This lab boasts of plenty of powerful computers preinstalled with MATLAB and Code Composer Studio (CCStudio), and high-speed Digital Signal Processors of the TMS320C6713 Digital Starter Kit (DSK) family by Texas Instruments. Using these, students are able to perform real-time analysis of signals and get hands-on experience about the theory they have learned in the class. This is used as regular lab for undergraduate students. Some research scholar uses this lab for development of algorithms which can be ported to hardware for real time applications.

3. PREREQUISITES:

The prerequisites for this lab are signals and systems, General mathematical formulas and basic knowledge in digital signal including the fundamentals.

6. JNTUH SYLLABUS: The lab course should be planned as per the JNTUH syllabus.

In this, LEAD experiments should also be included in cycle of experiments

16. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
17. Histogram of White Gaussian Noise and Uniformly Distributed Noise.
18. To find DFT / IDFT of given DT Signal
19. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
20. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
21. Implementation of FFT of given Sequence
22. Determination of Power Spectrum of a given Signal(s).
23. Implementation of LP FIR Filter for a given Sequence/Signal.
24. Implementation of HP IIR Filter for a given Sequence/Signal
25. Generation of Narrow Band Signal through Filtering
26. Generation of DTMF Signals
27. Implementation of Decimation Process
28. Implementation of Interpolation Process
29. Implementation of I/D Sampling Rate Converters
30. Impulse Response of First order and Second Order Systems.

EXPERIMENT NO. 1

Generation of Sinusoidal waveform/Signal based on recursive difference equations

OBJECTIVE

We generate the sinusoidal wave form and we will save the output samples in a buffer array and

Inspect the generated waveform both in the time and frequency domains using CCS's graphing capabili-

ties.

PREREQUISITES

Knowledge of basic sinusoidal signal generation

DESCRIPTION

a. Introduction to experiment -30 min

b. Connection of experiment and its verifications

c. Experimental determination of sinusoidal wave form

d. Graphical determination of sinusoidal wave in time and frequency

APPLICATIONS

3. AC supply.
4. Linear network.

EXPERIMENT NO. 2

Histogram of White Gaussian Noise and Uniformly Distributed Noise.

OBJECTIVE

To find Histogram of White Gaussian Noise and Uniformly Distributed Noise using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c.Use the appropriate library function

d.Display the waveform

APPLICATIONS

2. Communication

EXPERIMENT NO. 3

To find DFT/IDFT of given DT signal

OBJECTIVE

4. To study and investigate the Discrete Fourier Transform
5. To learn how to implement the operation using MATLAB
6. To learn how to analyze discrete-time signal using DFT

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c.Use the appropriate library function

d.Display the waveform

APPLICATIONS

3. In Sinusoidal wave forms
4. In signals

EXPERIMENT NO. 4

To find frequency response of a given system given in (Transfer function/Differential equation form)

OBJECTIVE

We will generate the signal and we will find the frequency response of the given system in Transfer function /Differential equation form and graphical representation of the output signal.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

2. Used to compute the coefficients of a discrete Fourier series.

EXPERIMENT NO.5

Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.

OBJECTIVE

To Obtain Fourier series coefficients by formula and using FET and compare for half sine wave using MATLAB.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in radio communications, Radars

EXPERIMENT NO.6

Implementation of FFT of given sequence

OBJECTIVE

To find the FFT of a given sequence using MATLAB.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

Communication, Signal processing

EXPERIMENT NO.7

Determination of Power spectrum of a given signal(s)

OBJECTIVE

To find the power spectrum of a given signal

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in radio communications, Radars

EXPERIMENT NO.8

Implementation of LP FIR filter for a given sequence.

OBJECTIVE

To find the frequency response of LP FIR filter.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1. Low pass filters are extensively used in the design of decimators and interpolators.

EXPERIMENT NO.9

Implementation of HP IIR filter for a given sequence.

OBJECTIVE

To find the frequency response of HP IIR filter.

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used to remove noise in audio signals.

EXPERIMENT NO.10

Generation of Narrow Band Signal through Filtering

OBJECTIVE

To implement the Decimation process using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in filters to improve efficiency

EXPERIMENT NO.11

2. Generation of DTMF Signals

OBJECTIVE

To generate DTMF using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in communication

EXPERIMENT NO.12

Implementation of Decimation Process

OBJECTIVE

To implement the Decimation process using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in filters to improve efficiency

EXPERIMENT NO.13

Implementation of Interpolation Process

OBJECTIVE

To implement the Interpolation process using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1.Used in filters to improve efficiency

EXPERIMENT NO.14

Implementation of I/D sampling rate converters.

OBJECTIVE

To implement I/D sampling rate converters using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1. Used in Image processing

EXPERIMENT NO.15

Impulse Response of First order and Second Order Systems

OBJECTIVE

To Impulse Response of First order and Second Order Systems using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for signal generation

c. Use the appropriate library function

d. Display the waveform

APPLICATIONS

1. Used in Signal Processing

7. LEAD EXPERIMENT

Implementation DFT and IDFT on a Image: (With using built in functions)

OBJECTIVE

To find DFT and IDFT on a Image using MATLAB

DESCRIPTION

a. Introduction to experiment -30 min

b. Get the inputs for image generation

c. Use the appropriate library function

d. Display images

APPLICATIONS

b. Used in image processing.

11. LEAD Experiment:

1)DFT and IDFT on a Image

Theory:

For processing 1-D or 2-D signals (especially coding), a common method is to divide the signal into "frames" and then apply an invertible transform to each frame that compresses the information into few coefficients.
Discrete cosine transform (DCT) can linearly transform data into the frequency domain, where the data can be represented by a set of coefficients. The advantage of DCT is that the energy of the original data may be concentrated in only a few low frequency components of DCT depending on the correlation in the data.
DCT express a signal (a set of numbers) in terms of a sum of cosine functions with different frequencies. For example, given a set A of n values,

$A = \{a_0, a_2, \ldots, a_{n-1}\}$

one dimensional discrete cosine transform coefficients (actually the weights) are given by

$$w_k = \sum_{t=0}^{n-1} a_t \cos\left[\frac{\pi}{n}\left(t+\frac{1}{2}\right)k\right],\ k = 0, \ldots, n-1$$

To make DCT values orthogonal, we multiply the terms by scale factors $1/\sqrt{2}$ and $\sqrt{2/n}$. Remember that if two lines are orthogonal if they are perpendicular at their point of intersection. Similarly, two vectors are orthogonal if and only if their dot product ($a \cdot b = \|a\|\|b\|\cos\theta$, where $\|a\|$ denotes the length or magnitude of a) is zero. Two vectors in an inner product space are orthonormal if they are orthogonal and both of unit length. This boring stuff are all related to DCT, but you can simply ignore if you are not interested in.

$$w_k = c_k\sqrt{\frac{2}{n}}\sum_{t=0}^{n-1} a_t \cos\left[\frac{\pi}{n}\left(t+\frac{1}{2}\right)k\right],$$

$$c_k = \begin{cases} \frac{1}{\sqrt{2}}, & k = 0 \\ 1, & k > 0 \end{cases}, \qquad k = 0, \dots, n-1.$$

Let us rewrite w_0 for k=0 in the expanded form,

$$w_0 = a_0\sqrt{\frac{1}{n}}\cos\left[\frac{\pi}{n}\left(0+\frac{1}{2}\right)0\right] + a_1\sqrt{\frac{1}{n}}\cos\left[\frac{\pi}{n}\left(1+\frac{1}{2}\right)0\right] + a_2\sqrt{\frac{1}{n}}\cos\left[\frac{\pi}{n}\left(2+\frac{1}{2}\right)0\right] + \cdots + a_{n-1}\sqrt{\frac{1}{n}}\cos\left[\frac{\pi}{n}\left(n-1+\frac{1}{2}\right)0\right]$$

$$w_0 = \sqrt{\frac{1}{n}}(a_0 + a_1 + a_0 + \cdots + a_{n-1})$$

$$w_0 = \frac{a_0 + a_1 + a_0 + \cdots + a_{n-1}}{\sqrt{n}}.$$

The first coefficient w_0 is called as DC (direct current, zero frequency) coefficient, and $\frac{w_0}{\sqrt{n}}$ is simply the mean of the set A.

Let us rewrite the formulation for the rest of the coefficients (they are called as AC, alternative current coefficients):

$$w_k = a_0\sqrt{\frac{2}{n}}\cos\left[\frac{\pi}{n}\left(0+\frac{1}{2}\right)k\right] + a_1\sqrt{\frac{2}{n}}\cos\left[\frac{\pi}{n}\left(1+\frac{1}{2}\right)k\right] + a_2\sqrt{\frac{2}{n}}\cos\left[\frac{\pi}{n}\left(2+\frac{1}{2}\right)k\right] + \cdots + a_{n-1}\sqrt{\frac{2}{n}}\cos\left[\frac{\pi}{n}\left(n-1+\frac{1}{2}\right)k\right].$$

If A consists of correlated values, then most of the DCT coefficients (w_0 and w_k) produced will be zero or small numbers, and only a few are large. The early DCT coefficients (e.g., w_1, w_2) corresponds to low-frequency components of the image information. The low-frequency components usually contain the important image information. The later coefficients (e.g., w_{n-2}, w_{n-1}) contain the less-important (high-frequency components) image information.

Let's do an experiment. Given the set A, where elements of A are correlated numbers. If we apply DCT to a set, it will result in 8 DCT coefficients.

A=[1 2 3 4 5 6 7 8]

WA=[12.7279 -6.4423 0 -0.6735 0 -0.2009 0 -0.0507]

Let us ignore the coefficients with absolute values smaller than one.

WA'=[12.7279 -6.4423 0 0 0 0 0 0]

If we apply the inverse1 DCT transform to W', we can reconstruct the original data set A with a small mean square error (0.4965).

A=[1 2 3 4 5 6 7 8]

A=[1.3407 1.8217 2.7104 3.8716 5.1284 6.2896 7.1783 7.6593]

The energy of A is concentrated by DCT in only two coefficients because the elements in A are correlated.
Here is the Matlab code for this experiment.

```
A   = 1:8;
W   = dct(A);
W_q = W;
W_q(abs(W_q)<1) = 0;
A_q = idct(W_q);
mse = mean(sum((A-A_q).^2))
```

On the other hand, if we apply DCT to a set of uncorrelated numbers, it will result in coefficients with large values. Consider the set B given below. If we apply DCT to B, the total energy (sum of the absolute values of the coefficients) of DCT coefficients is 42.0907.

B =[1 5 -9 -8 7 1 0 9]

WB =[2.1213 -6.0855 7.5688 5.2571 4.2426 -11.8857 -3.9005 1.0293]

Therefore, if you plan to use DCT for data compression, you should first find a good way to represent your data where the elements are correlated. For example, let us naively sort the elements of B and then apply DCT to the sorted set.

B_s = [-9 -8 0 1 1 5 7 9]

WB_s = [2.1213 -16.4520 -2.0719 -3.5681 -0.7071 1.8680 2.3890 0.3323]

In this case, the total energy is 29.5097.

Here is the Matlab code for this experiment.

```
B   = [1 5 -9 -8 7 1 0 9];

W   = dct(B);

sumW = sum(abs(W));

B_s = sort(B);

W_s = dct(B_s);

sumW_s = sum(abs(W_s));
```

One interesting feature of DCT is that the value of n (number of the elements in the data set) plays a critical role in the calculations. Most applications employing the DCT use 8 as the value of n. The table below shows the value of $\frac{(2t+1)f\pi}{2n}$ in degrees for n=8, t=0,..,n-1, and k=0,..,n-1.

	k\t	0	1	2	3	4	5	6	7
low freq. (DC)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1	11.25	33.75	56.25	78.75	101.25	123.75	146.25	168.75
	2	22.50	67.50	112.50	157.50	202.50	247.50	292.50	337.50
	3	33.75	101.25	168.75	236.25	303.75	11.25	78.75	146.25
	4	45.00	135.00	225.00	315.00	45.00	135.00	225.00	315.00
	5	56.25	168.75	281.25	33.75	146.25	258.75	11.25	123.75
	6	67.50	202.50	337.50	112.50	247.50	22.50	157.50	292.50
high freq.	7	78.75	236.25	33.75	191.25	348.75	146.25	303.75	101.25

We us the first row to calculate w_0 and similarly use the second row to calculate w_1, and so on so forth. When we calculate DCT coefficients, we have a set of n input numbers and we have n coefficients. For each DCT coefficients, we have a base frequency f. If we draw the cosine values, it will be very clear how the cosine signal changes with increasing frequency.

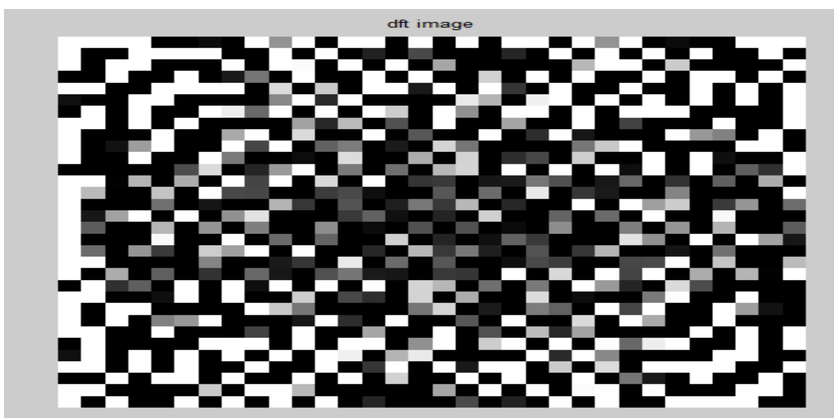
Matlab code:

```
clc;
close all;
clear all;
f=imread('cameraman.tif');
[M N]=size(f);
imshow(f);
title('cameraman');
k=fft2(f);
k=fft2(f,M,N);
figure,imshow(k);
title('dft image');
imwrite(k,'dftimage.tif');
q=imread('dftimage.tif');
p=ifft2(q);
p=ifft2(q,M,N);
figure,imshow(q);
title('idft image');
```

SIMULATION RESULTS

Input image:

DFT image:



IDFT image:

REMOVAL NOISE FROM NOISY SIGNAL

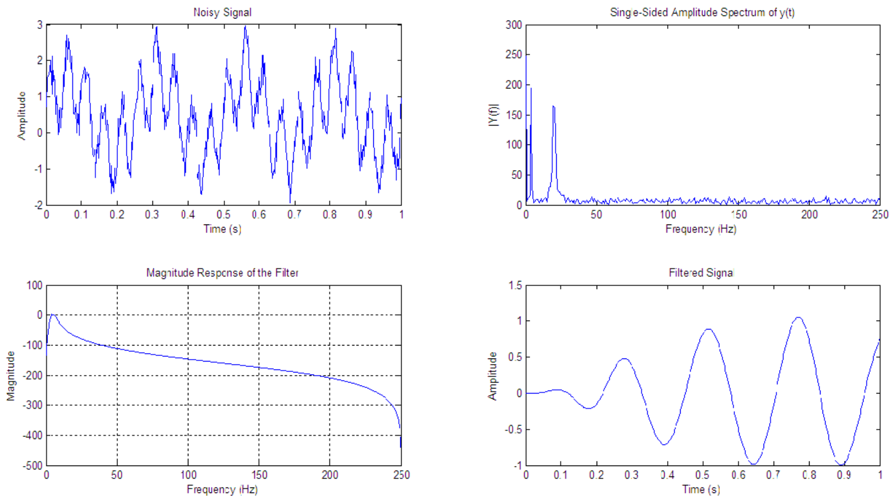
Spectral subtraction is used in this research as a method to remove noise from noisy speech signals in the frequency domain. This method consists of computing the spectrum of the noisy speech using the Fast Fourier Transform (FFT) and subtracting the average magnitude of the noise spec-trum from the noisy speech spectrum. We applied spectral subtraction to the speech signal “Real graph”. A digital audio recorder system embedded in a personal computer was used to sample the speech signal “Real graph” to which we digitally added vacuum cleaner noise. The noise removal algorithm was implemented using Matlab software by storing the noisy speech data into Hanning time-widowed half-overlapped data buffers, computing the corresponding spectrums using the FFT, removing the noise from the noisy speech, and reconstructing the speech back into the time domain using the inverse Fast Fourier Transform (IFFT). The performance of the algorithm was evaluated by calculating the Speech to Noise Ratio (SNR). Frame averaging was introduced as an optional technique that could improve the SNR. Seventeen different configurations with various lengths of the Hanning time windows, various degrees of data buffers overlapping, and various numbers of frames to be averaged were investigated in view of improving the SNR. Results showed that using one-fourth overlapped data buffers with 128 points Hanning windows and no frames averaging leads to the best performance in removing noise from the noisy speech.

Program:

```
clc
close  all;
clear all;
Fs = 500;
f = 20;
n = [1/Fs:1/Fs:1];
x = sin(2*pi*f*n) + sin(2*pi*f*n/5);
% add noise to the signal
y = x + rand(1,length(x));
% plot the noisy signal
subplot(2,2,1); plot(n,y);
title('Noisy Signal');
```

```
xlabel('Time (s)');
ylabel('Amplitude');
%% Spectral analysis of the signal
L = length(y);
NFFT = 2^nextpow2(L);
y_fft = abs(fft(y,NFFT));
% creating frequency axis
freq = Fs/2*linspace(0,1,NFFT/2+1);
% Plot single-sided amplitude spectrum.
subplot(2,2,2);
plot(freq,y_fft(1:NFFT/2+1));
title('Single-Sided Amplitude Spectrum of y(t)');
xlabel('Frequency (Hz)');
ylabel('|Y(f)|');
%% Design Filter and apply on the sequence
o = 5;
wn = [3 7]*2/Fs;
[b,a] = butter(o,wn,'bandpass');
% see frequency response of the filter
[h,w] = freqz(b,a,1024,Fs);
subplot(2,2,3);
plot(w,20*log10(abs(h)));
title('Magnitude Response of the Filter');
xlabel('Frequency (Hz)');
ylabel('Magnitude');grid on;
% Filter the signal
y_filt = filter(b,a,y);
subplot(2,2,4);
plot(n,y_filt);
title('Filtered Signal');
xlabel('Time (s)');
ylabel('Amplitude');
```

Output:



12. VIRTUAL LAB EXPERIMENT:

A FIR filter is a digital filter whose impulse response settles to zero in finite time as opposed to an infinite impulse response filter (IIR), which uses feedback and may respond indefinitely to an input signal. The great thing about FIR filters is that they are inherently stable and can easily be designed to have linear phase. I won't get into the details much further on FIR filters and their pro's and con's as this tutorial focuses more on designing filters fast and efficiently with the aid of Octave.

Typically, in FIR filter design the length of the filter will need to be specified. You can guess and check until the filter matches your expected bandwidth and cutoff requirements, but this could be a long and tedious process. The equation below is an efficient way to compute a reasonable starting length. After trying the calculated N, one can then tweak N or parameters which make up N to meet filter specifications.

Designing an FIR filter length to be odd length will give the filter an integral delay of (N-1)/2.

Using the Octave/Matlab code below, we can see how to design a lowpass filter with a bandwidth of 10kHz and a cutoff of 15kHz using Octave's built in fir1 function, which is well documented here

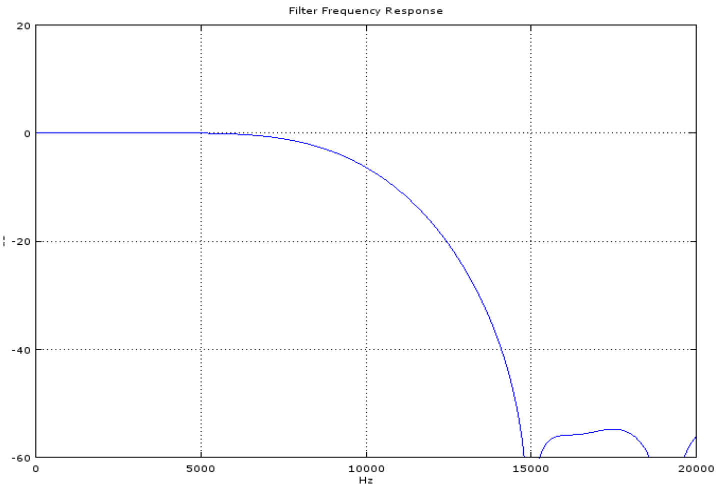
<u>Octave Code:</u>

```
close all;
clear all;
clf;
f1 = 10000;
f2 = 15000;
delta_f = f2-f1;
Fs = 192000;
dB  = 40;
```

```
N = dB*Fs/(22*delta_f);

f =  [f1 ]/(Fs/2)
hc = fir1(round(N)-1, f,'low')


figure
plot((-0.5:1/4096:0.5-1/4096)*Fs,20*log10(abs(fftshift(fft(hc,4096)))))
axis([0 20000 -60 20])
title('Filter Frequency Response')
grid on
```



13. SUGGESTED BOOKS:

1. Digital signal processing, principles, algorithms and applications: Johnn G.Proakis, Dimitris G.Monalakis, Pearson Education/PHI 2007

2. Discrete Time Signal Processing –A.V.Oppenheim and R.W.Schaffer,PHI 2009

3. Fundamentals of Digital Signal Processing-Loney Ludeman, John Wiley, 2009

14. WEB SITES (USEFUL LINKS):

1. NPTEL VIDEO LECTURES:

https://nptel.ac.in/courses/117/102/117102060/

2. COURSERA:

https://www.coursera.org/learn/matlab3.

3.MATH WORKS:

https://in.mathworks.com/matlabcentral/fileexchange/58879-digital-signal-processing-lab-exercises4.

4.EDX:

https://www.edx.org/course/discrete-time-signal-processing-4

5. UDEMY:

https://www.udemy.com/course/digital-signal-processing-with-matlab/

15. EXPERT DETAILS

REGIONAL:

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1. Dr. Neelakandan Rajamohan

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Contact Number:+47 465 65 641

Url:https://scholar.google.com/citations?user=8H5s9vEAAAAJ&hl=en

E-mail address: enwcsiu@polyu.edu.hk

16. **(A) LAB SCHEDULE:** The lab schedule should be planned once in a week. The week wise Scheduled experiment should be completed.

CYCLE 1 (For 30 students per session and 3 students per batch)

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7	week-8
B1, B2	Demo	Exp.1	Exp.2	Exp.10	Exp.9	Exp.7	Exp.8	Lead1
B3, B4	Demo	Exp.2	Exp.10	Exp.9	Exp.8	Exp.1	Exp.3	Lead1
B5, B6	Demo	Exp.10	Exp.9	Exp.8	Exp.1	Exp.2	Exp.7	Lead1
B7, B8	Demo	Exp.9	Exp.8	Exp.1	Exp.3	Exp.10	Exp.2	Lead1
B9, B10	Demo	Exp.8	Exp.1	Exp.2	Exp.7	Exp.3	Exp.10	Lead1

CYCLE 2(For 30 students per session and 3 students per batch)

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**	week-7	week-8
B1, B2	Exp.3	Exp.4	Exp.6	Exp.11	Exp.12	Exp.5	Hobby/lead2	test
B3, B4	Exp.7	Exp.6	Exp.11	Exp.12	Exp.5	Exp.4	Hobby/lead2	test
B5, B6	Exp.3	Exp.11	Exp.12	Exp.5	Exp.4	Exp.6	Hobby/lead2	test
B7, B8	Exp.7	Exp.12	Exp.5	Exp.4	Exp.6	Exp.11	Hobby/lead2	test
B9, B10	Exp.9	Exp.5	Exp.4	Exp.6	Exp.11	Exp.12	Hobby/lead2	test

(B) VIVA SCHEDULE: The viva schedule should be planned prior starting to the lab experiment.

ROUND - 1

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**
B1,B2,B3, B4	viva					
B5,B6,B7,B8		viva				
B9,B10,B11,B12			viva			
B13,B14,B15,B16				viva		
B17,B18,B19,B20					viva	
						Viva

ROUND - 2

Batches	week-1	week-2	week-3	week-4	week-5
SG1	viva				
SG2		viva			
SG3			viva		
SG4				viva	
SG5					viva

*SG: Selected Group with a maximum of 6 or 12 students

(C) SCHEME OF EVALUATION

LAB EXTERNAL

S no.	Write-up (by Internal examiner)	Final evaluation (Internal Examiner)	Viva (External Examiner)
1	Aim Equipment needed MATLAB code Theoretical-Calculations Expected graph	Based on observation, how the student is writing the code, usage of software And based on correctness of the practical graph to the expected graph and results.	Based on understanding of Experiment and theoretical questions in the related subject.
	Marks: 20	**Marks: 40**	**Marks: 15**
Total Marks:20+40+15=75 Marks			

LAB INTERNAL

Day to Day Evaluation ------ 15 Marks					**Internal Exam ---10M Marks**		
Uniform	Observation & Record	Performance of experiment	Result	Viva Voce	Write-up	Connections & Result	Viva Voce
Marks: 3	**Marks:3**	**Marks:3**	**Marks: 3**	**Marks: 3**	**Marks:4**	**Marks :3**	**Marks :3**
Total Marks:15+10=25 Marks							

13. MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D:

The lab course is designed in such a way that it meets the requirements of research and development as well as consultancy projects. Also the Proposals of Project/R&D/Consultancy are as follows:

Proposal 1: Project Design & Execution

Proposal 2: R& D Level Project Design & Execution

Proposal 3: Consultancy Task / Project Design & Development

PROPOSAL FOR R & D ACTIVITY:

1. An exact paper from a National/International journal in this entitled area/subject/area (IEEE Format) AND/OR
2. An article/white paper from a magazine /journal/weekly/any periodical in the entitled subject AND/OR
3. An Advanced technology development/ proposal/article publication from any source of Information

PROPOSALS 2:

Abstract

We can capture an input signal, observe its waveform and variation with time on an oscilloscope, but further processing of the signal is not feasible with it. When we need to digitize signals into samples and observe the waveform through plotting, we need a computer along with software

PROPOSAL FOR PROJECT ACTIVITY:

1. A Proposal of a hobby/mini/proto/general/model/proto type project with extended abstract, Block Diagram/Circuit/Flow diagram and clear references may be presented and executed.

Hobby Project:

Artifacts Removal in ECG Signal Using MATLAB

Theory:

The word *artifact* is similar to *artificial* in the sense that it is often used to indicate something that is not natural (i.e. man-made). In electrocardiography, an ECG artifact is used to indicate something that is not "heart-made." These include (but are not limited to) electrical interference by outside sources, electrical noise from elsewhere in the body, poor contact, and machine malfunction. Artifacts are extremely common, and knowledge of them is necessary to prevent misinterpretation of a heart's rhythm.

Pacing spikes

These are seen in someone whose implanted pacemaker is firing.

The sharp, thin spike seen in figure x-x is an electrical signal produced by an artificial pacemaker. The wide QRS complex that follows it represents the ventricles depolarizing. We say that the "(artificial) pacemaker *captures"* when it is able to successfully depolarize its intended target. If a pacing spike is not followed by its intended response, we say that it has *failed to capture*.

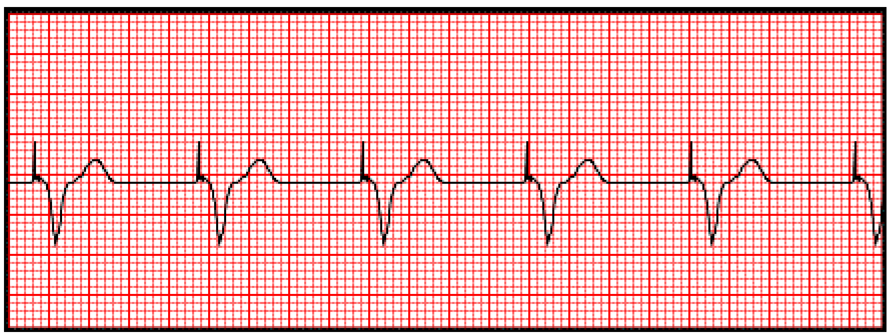


Figure 12-1 : Artificial pacemaker spikes

The wide QRS suggests that the pacemaker was implanted in the ventricles.

Reversed leads / misplaced electrodes

Electrode/lead placement is very important. If one were to accidentally confuse the red and white lead cables (i.e. place the white one where the red one should go, vice versa), he might get an ECG that looks like figure 12-2. In this ECG, we can make out a normal sinus rhythm with all of the waves upside-down. When this happens, you are essentially viewing the rhythm in a completely different lead.

One must also make sure that the lead wires are actually plugged into the machine. If your talkative patient shows asystole, you should suspect this. Many machines are "smart" in that they can sense common errors of this nature, but many such errors aren't always readily apparent.

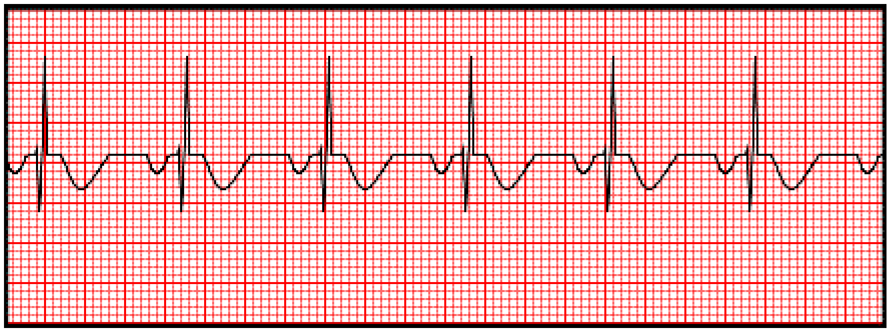


Figure 12-2 : reversed leads

AC interference

Alternating current (AC) describes the type of electricity that we get from the wall. In the United States, the electricity "changes direction" 60 times per second (i.e. 60 hertz). (Many places in Europe use 50 Hz AC electricity.) When an ECG machine is poorly grounded or not equipped to filter out this interference, you can get a thick looking ECG line (as shown in figure 12-3). If one were to look at this ECG line closely, he would see 60 up-and-down wave pattern in a given second (25 squares).

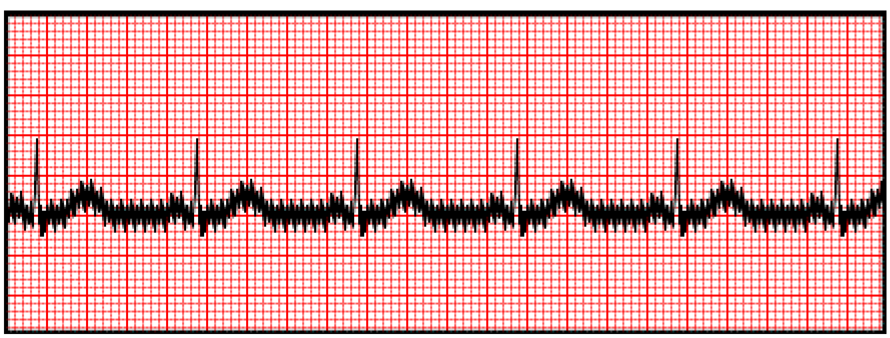


Figure 12-3 : 60 Hz AC interference

Muscle tremor / noise

The heart is not the only thing in the body that produces measurable electricity. When your skeletal muscles undergo tremors, the ECG is bombarded with seemingly random activity. The term *noise* does not refer to sound but rather to electrical interference.

Low amplitude muscle tremor noise can mimic the baseline seen in atrial fibrillation. Muscle tremors are often a lot more subtle than that shown in figure 12-4.

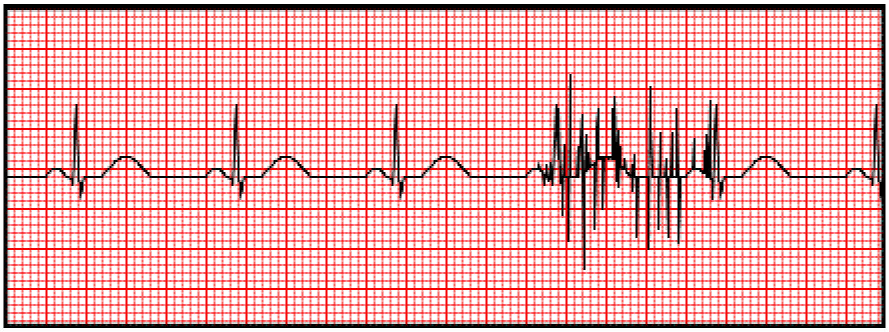


Figure 12-4 : Muscle tremors

Wandering baseline

In wandering baseline, the isoelectric line changes position. One possible cause is the cables moving during the reading. Patient movement, dirty lead wires/electrodes, loose electrodes, and a variety of other things can cause this as well.

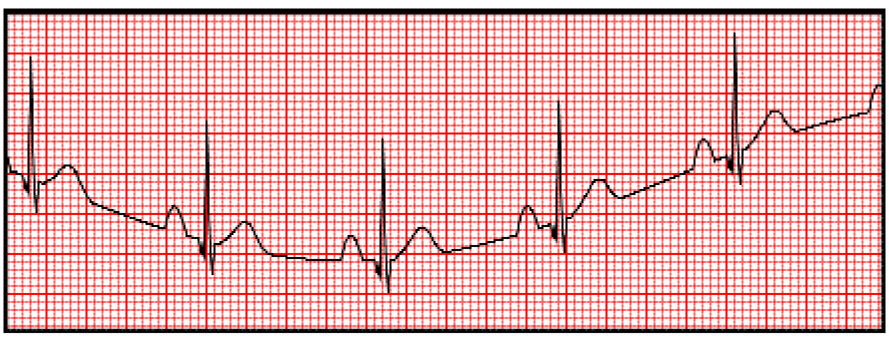


Figure 12-5 : Wandering baseline artifact

Absolute heart block

Absolute heart block (or 4th degree heart block) results from over-exposure to imported-liquor advertisements in magazines. QRS complexes are wide and bottle-shaped and show no relationship with the P wave. It occurs very rarely, and even then, only in fictional settings. This should not be confused with the real arrhythmia *complete heart block*.

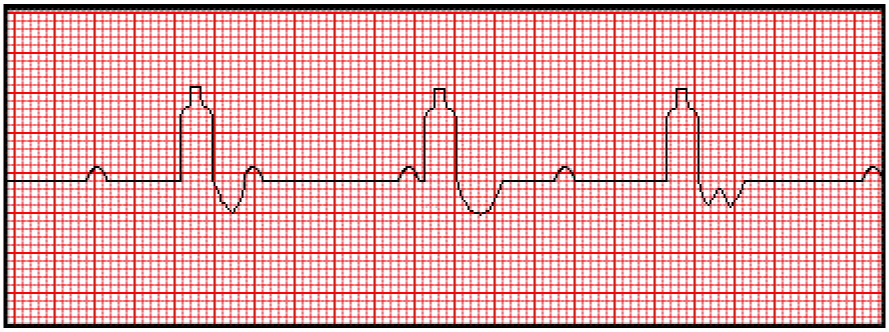
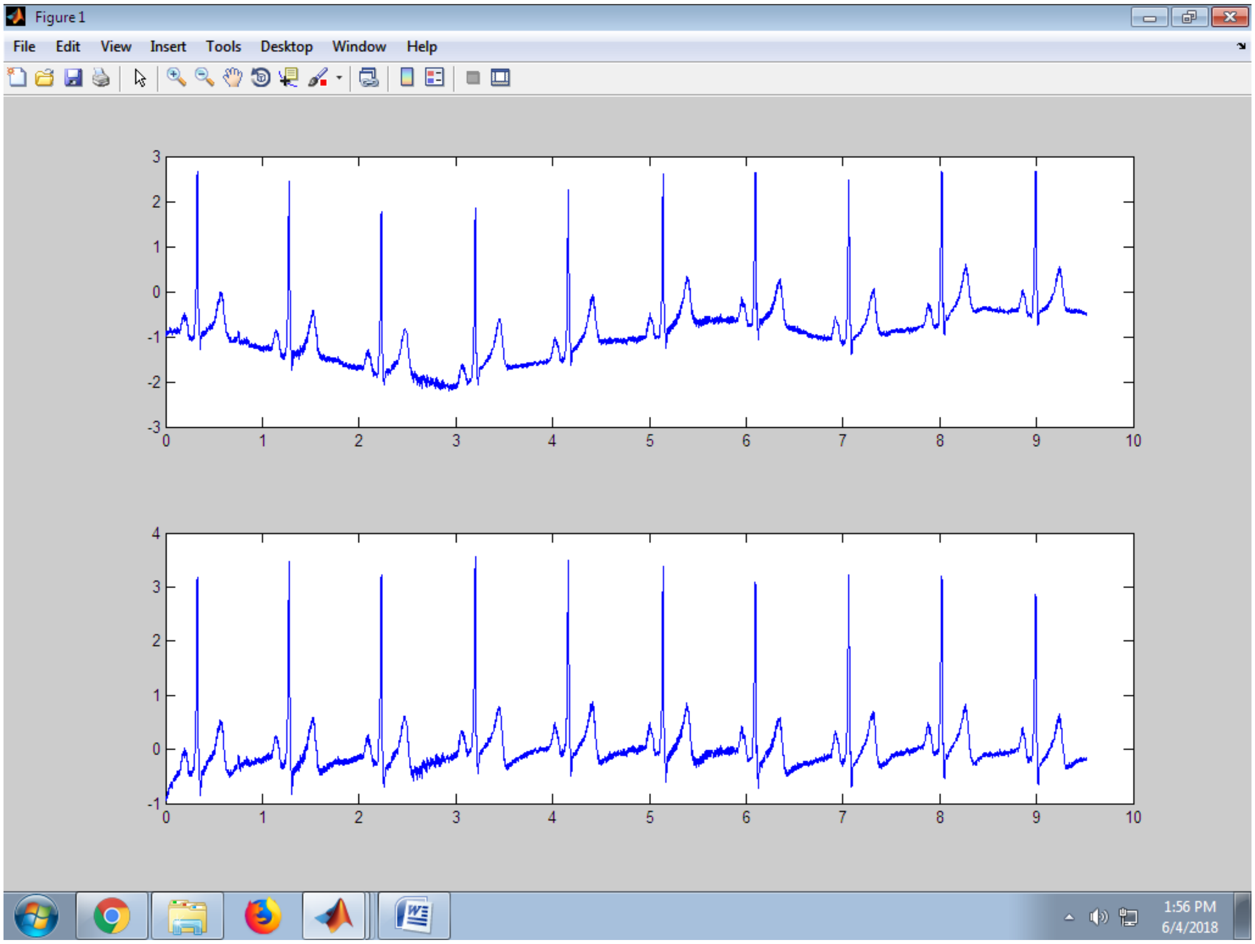


Figure 12-6 : Absolute heart block

CODE:

```
% MATLAB PROGRAM ecg_lfn.m
clear all              % clears all active variables
close all

ecg = load('ecg_lfn.dat');
L=length(ecg);
fs = 1000; %sampling rate = 1000 Hz
 %slen = length(ecg);
t=[1:L]/fs;
%figure
%plot(t,ecg)
%axis tight;
%xlabel('Time in seconds');
%ylabel('ECG');
b=[1,-1]
a=[1,-0.995]
figure,
t1=zplane(b,a,(1/fs))
[h,f]=freqz(b,a,L,fs);
%subplot(211)
%plot(f,abs(h))
[ph,f]=phasez(b,a,L,fs)
%subplot(212)
%plot(f,ph)
out=filter(b,a,ecg);
subplot(211)
plot(t,ecg);
subplot(212)
plot(t,out);
E_ref=sum(out.^2);
noise=ecg-out;
E_noise=sum(noise.^2);
SNR=10*log10(E_ref/E_noise)
```

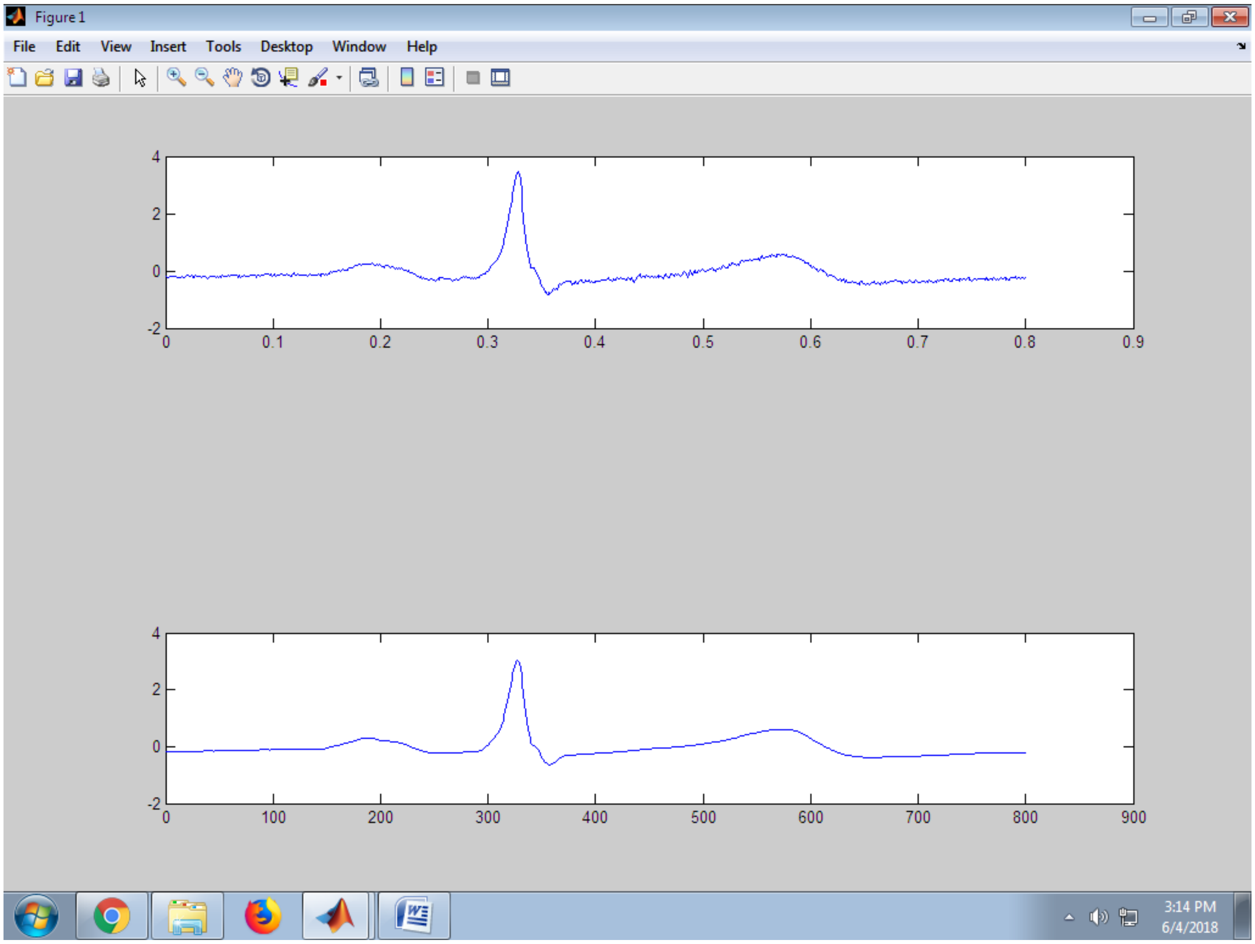



```
% MATLAB PROGRAM ecg_lfn.m
clear all              % clears all active variables
close all

ecg = load('ecg_lfn.dat');
L=length(ecg);
fs = 1000; %sampling rate = 1000 Hz

%slen = length(ecg);
t=[1:L]/fs;
%figure
%plot(t,ecg)
%axis tight;
%xlabel('Time in seconds');
%ylabel('ECG');
b=[1,-1]
a=[1,-0.995]
figure,
t1=zplane(b,a,(1/fs))
```

```
[h,f]=freqz(b,a,L,fs);
%subplot(211)
%plot(f,abs(h))
[ph,f]=phasez(b,a,L,fs)
%subplot(212)
%plot(f,ph)
out=filter(b,a,ecg);
%subplot(211)
%plot(t,ecg);
%subplot(212)
%plot(t,out);
temp_start=950;
L_temp=801;
temp=out(temp_start:(temp_start+L_temp-1));
t2=(1:L_temp)/fs
subplot(311)
plot(t2,temp);
n=floor(L_temp/2);
x1=[zeros(n,1);out;zeros(n,1)]
for i=1:length(out)
    prod=temp.*x1(i:i+L_temp-1);
    cross_corr(i)=sum(prod)/(norm(temp)*norm(x1(i:i+L_temp-1)));
end
%subplot(312)
%plot(t,cross_corr);
noisy_ecg=cross_corr;
threshold=0.9;
idx=find(cross_corr > threshold);
for i=1:length(idx)-1
    if ((idx(i)-n)>=1)&&((idx(i)+n)<=length(out))
        sync_avg1(i,:)=out(idx(i)-n:idx(i)+n);
    end
end
sync_avg=mean(sync_avg1);
subplot(313)
plot(sync_avg);
E_ref=sum(sync_avg.^2);
noise=sync_avg-(temp)';
E_noise=sum(noise.^2);
SNR=10*log10(E_ref/E_noise)
```

SNR =

14.5169



PROPOSAL FOR CONSULTANCY

Proposed Equipment for usage:
A program/machine/product of utility may be proposed to develop for in house usage/Industrial requirements may be useful for any outside agency that can be marketable in order to generate revenue through consultancy.

Design and Simulation of (OFDM) Signaling

Abstract:

A MATLAB program has been written to investigate Orthogonal Frequency Division Multiplexing (OFDM) communication systems. This program is valuable for future researchers simulating systems that are too theoretically complex to analyze. Single-carrier QAM and multi-carrier OFDM are compared to demonstrate the strength of OFDM in multipath channels. Two graphical user interface demonstrations show some of the basic concepts of OFDM.

Introduction

The Electrical Engineering Senior Capstone Project is intended to give each student experience in completing a sophisticated design project that spans most of the senior year. Planning, management of time, allocation of responsibility, documentation, and presentation of the results are integrated with the technical design task. The students work with one or two faculty advisors who have expertise in the project research area. The student is fully responsible for the design project, with the advisor(s) acting as guide and mentor. Each student is expected to work an eight-hour lab period each week from October through May.

A common problem found in high-speed communication is inter-symbol interference (ISI). ISI occurs when a transmission interferes with itself and the receiver cannot decode the transmission correctly. For example, in a wireless communication system such as that shown in Figure 1, the same transmission is sent in all directions.

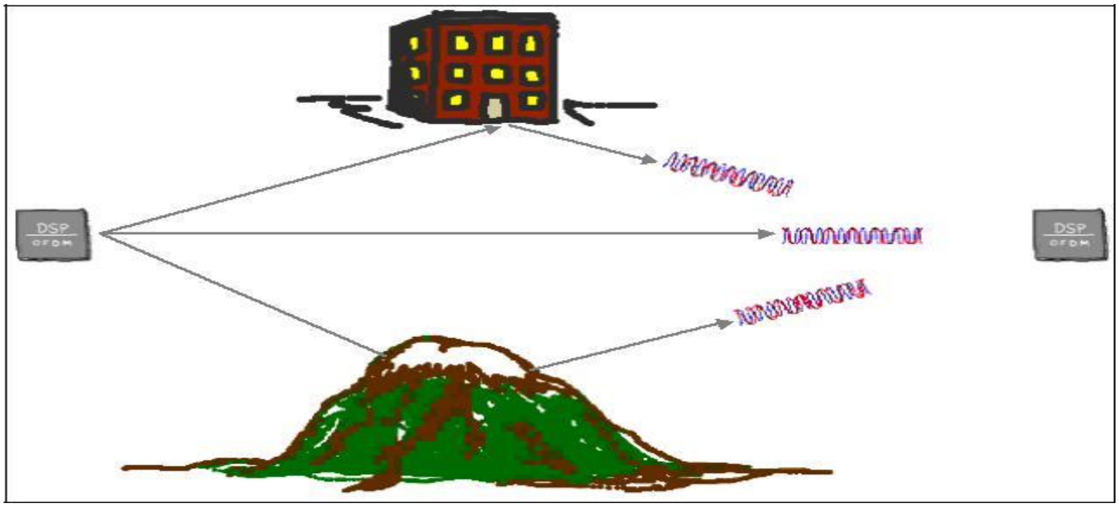


Figure 1: Multipath Demonstration

Theory

This project will focus on Orthogonal Frequency Division Multiplexing (OFDM) research and simulation. OFDM is especially suitable for high-speed communication due to its resistance to ISI. As communication systems increase their information transfer speed, the time for each transmission necessarily becomes shorter. Since the delay time caused by multipath remains constant, ISI becomes a limitation in high-data-rate communication [1]. OFDM avoids this problem by sending many low speed transmissions simultaneously. For example, Figure 2 shows two ways to transmit the same four pieces of binary data.

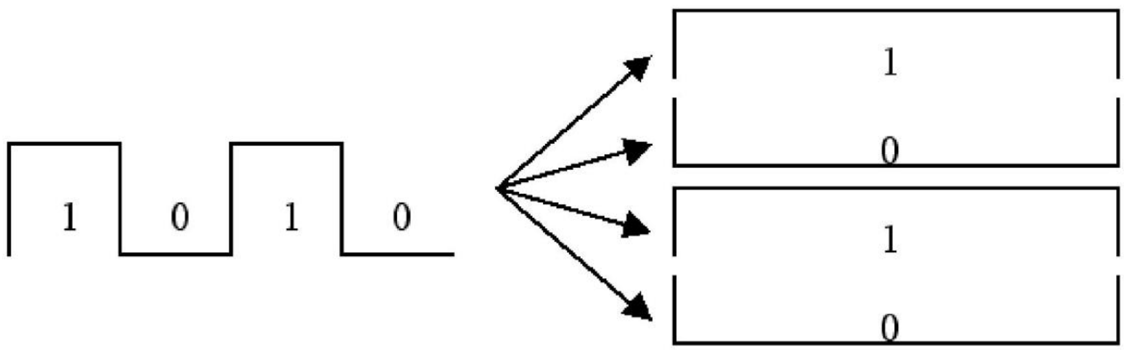


Figure 2: Traditional vs. OFDM Communication

Suppose that this transmission takes four seconds. Then, each piece of data in the left picture has a duration of one second. On the other hand, OFDM would send the four pieces simultaneously as shown on the right. In this case, each piece of data has a duration of four seconds. This longer duration leads to fewer problems with ISI. Another reason to consider OFDM is low-complexity implementation for high-speed systems compared to traditional single carrier techniques.

Significance

With the rapid growth of digital communication in recent years, the need for high-speed data transmission has increased. New multicarrier modulation techniques such as OFDM are currently being implemented to keep up with the demand for more communication capacity. Multicarrier communication systems "were first conceived and implemented in the 1960s, but it was not until their all-digital implementation with the FFT that their attractive features were unraveled and sparked widespread interest for adoption in various single-user and multiple access (MA) communication standards" . The processing power of modern digital signal processors has increased to a point where OFDM has become feasible and economical. Examining the patents, journal articles, and books available on OFDM, it is clear that this technique will have an impact on the future of communication. See the references section (starting on page 21) for a condensed bibliography and list of patents related to this topic. Since many communication systems being developed use OFDM, it is a worthwhile research topic. Some examples of current applications using OFDM include GSTN (General Switched Telephone Network), Cellular radio, DSL & ADSL modems, DAB (Digital Audio Broadcasting) radio, DVB-T (Terrestrial Digital Video Broadcasting), HDTV broadcasting, HYPERLAN/2 (High Performance Local Area Network standard), and the wireless networking standard IEEE

802.11.

Simulation Design

This project consists of research and simulation of an OFDM communication system. Figure 3 shows a simplified flowchart of the MATLAB simulation code.

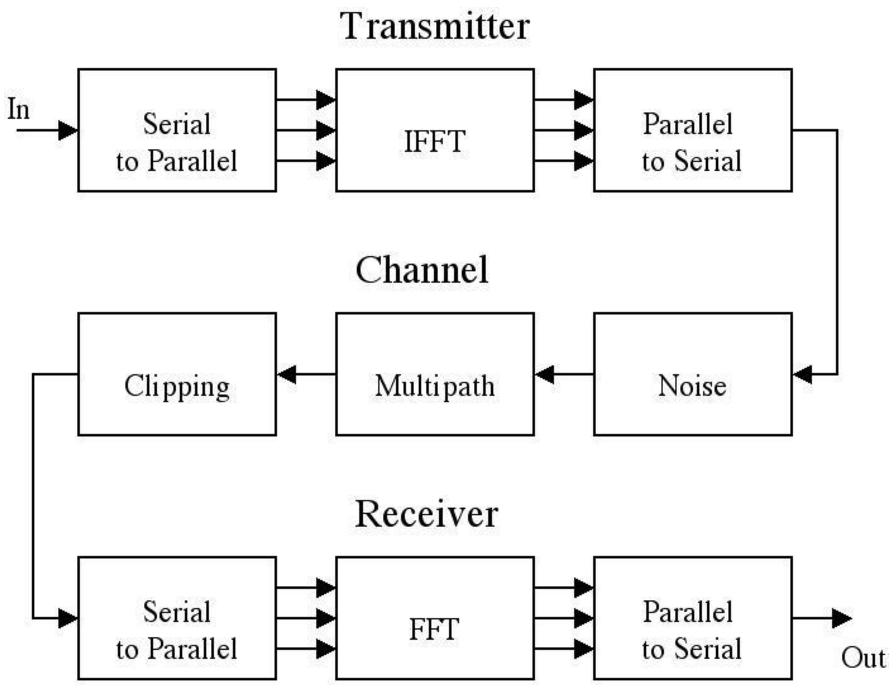


Figure 3: OFDM Simulation Flowchart

The transmitter first converts the input data from a serial stream to parallel sets. Each set of data contains one symbol, S_i, for each subcarrier. For example, a set of four data would be [S_0 S_1 S_2 S_3]. Before performing the Inverse Fast Fourier Transform (IFFT), this example data set is arranged on the horizontal axis in the frequency domain as shown in Figure 4.

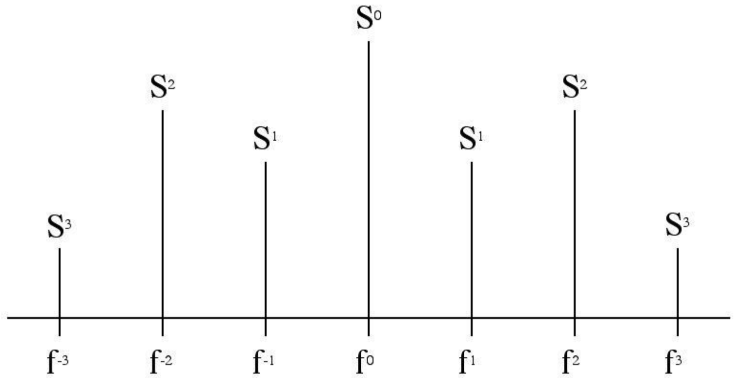


Figure 4: Frequency Domain Distribution of Symbols

This symmetrical arrangement about the vertical axis is necessary for using the IFFT to manipulate this data. An inverse Fourier transform converts the frequency domain data set into samples of the corresponding time domain representation of this data. Specifically, the IFFT is useful for OFDM because it generates samples of a waveform with frequency components satisfying orthogonality conditions. Then, the parallel to serial block creates the OFDM signal by sequentially outputting the time domain samples.

The channel simulation allows examination of common wireless channel characteristics such as noise, multipath, and clipping [5]. By adding random data to the transmitted signal, simple noise is simulated. Multipath simulation involves adding attenuated and delayed copies of the transmitted signal to the original. This simulates the problem in wireless communication when the signal propagates on many paths. For example, a receiver may see a signal via a direct path as well as a path that bounces off a building. Finally, clipping simulates the problem of amplifier saturation. This addresses a practical implementation problem in OFDM where the peak to average power ratio is high.

The receiver performs the inverse of the transmitter. First, the OFDM data are split from a serial stream into parallel sets. The Fast Fourier Transform (FFT) converts the time domain samples back into a frequency domain representation. The magnitudes of the frequency components correspond to the original data. Finally, the parallel to serial block converts this parallel data into a serial stream to recover the original input data.

Results

The MATLAB simulation accepts inputs of text or audio files as well as binary, sinusoidal, or random data. It then generates the corresponding OFDM transmission, simulates a channel, attempts to recover the input data, and performs an analysis to determine the transmission error rate. In order to compare OFDM to a traditional single carrier communication system, a 16-QAM simulation can be performed. These simulations are dynamic, allowing the user to set parameters determining the characteristics of the communication system. Two simple demonstrations of OFDM communication were developed with a graphical user interface (GUI) following the style of MATLAB toolbox demonstrations. These allow someone to quickly learn the basic concepts of OFDM communication.

The first demonstration, basicgui (or basicgui_win), introduces the process of creating an OFDM symbol. It shows a simple example of using the Fourier transform to send binary data on four frequencies. The following screenshots show the demo sequence with explanations in the text box.

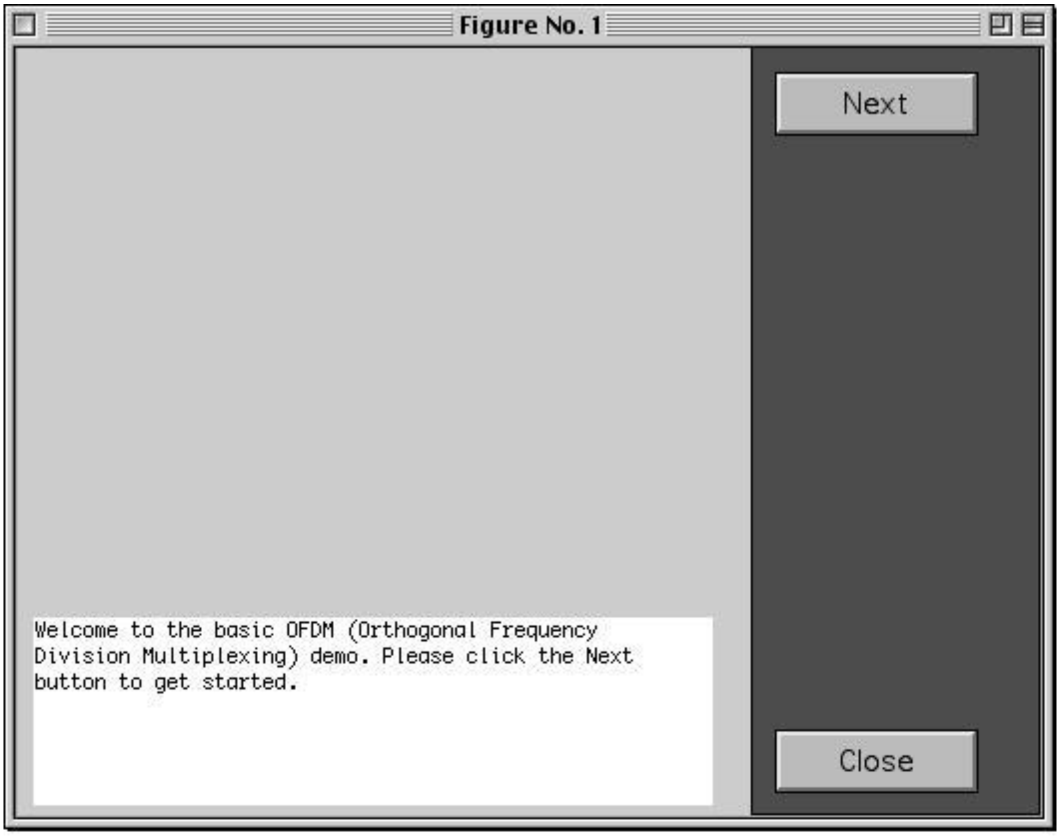


Figure No. 1
Next
Welcome to the basic OFDM (Orthogonal Frequency Division Multiplexing) demo. Please click the Next button to get started.
Close

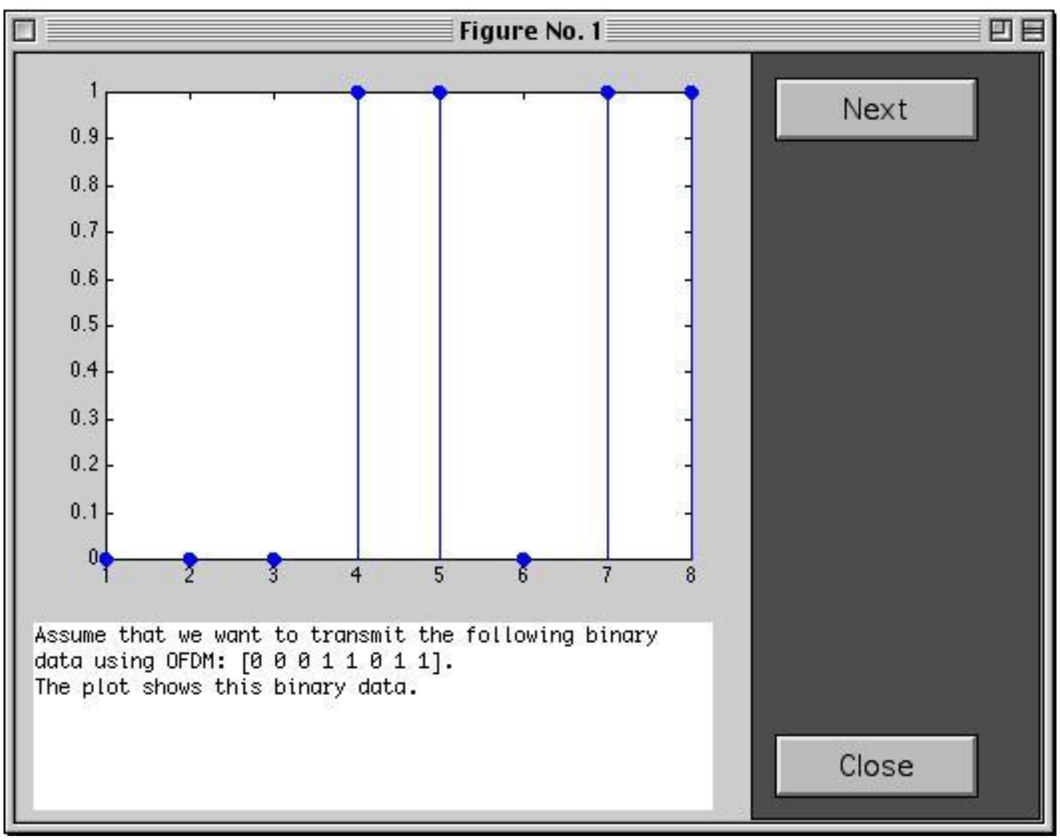


Figure No. 1
Next
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8
Assume that we want to transmit the following binary data using OFDM: [0 0 0 1 1 0 1 1].
The plot shows this binary data.
Close

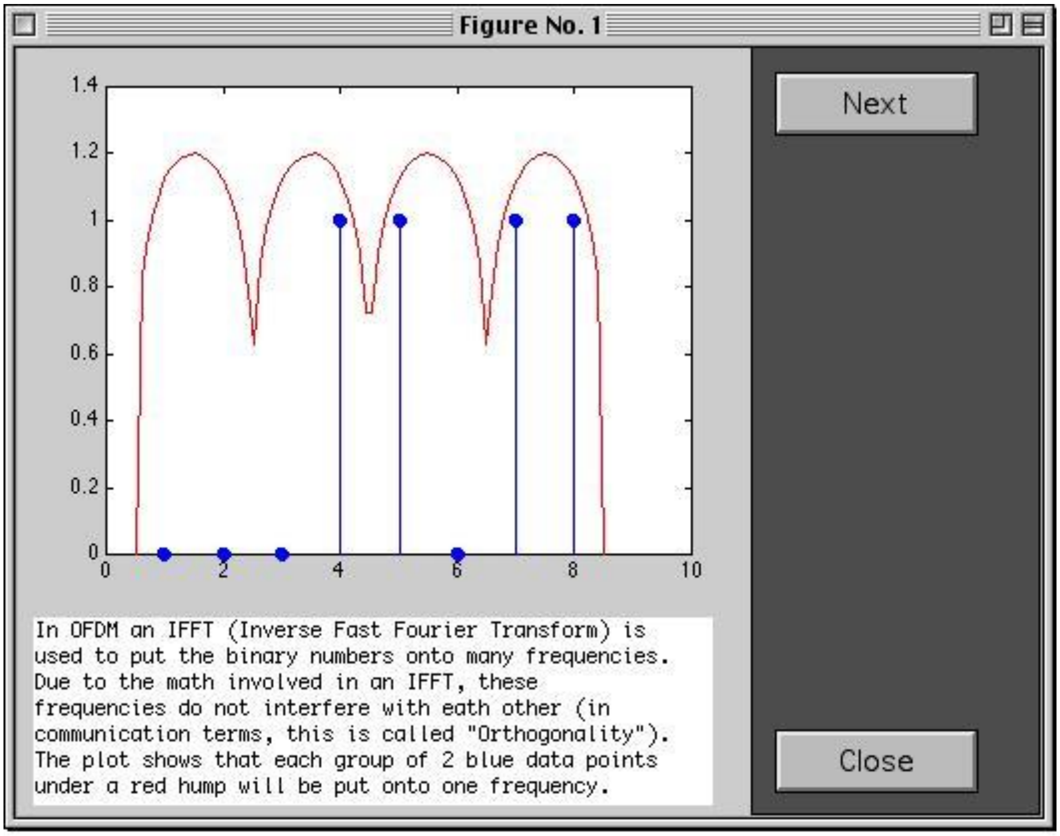


Figure No. 1
Next
Close
In OFDM an IFFT (Inverse Fast Fourier Transform) is used to put the binary numbers onto many frequencies. Due to the math involved in an IFFT, these frequencies do not interfere with eath other (in communication terms, this is called "Orthogonality"). The plot shows that each group of 2 blue data points under a red hump will be put onto one frequency.

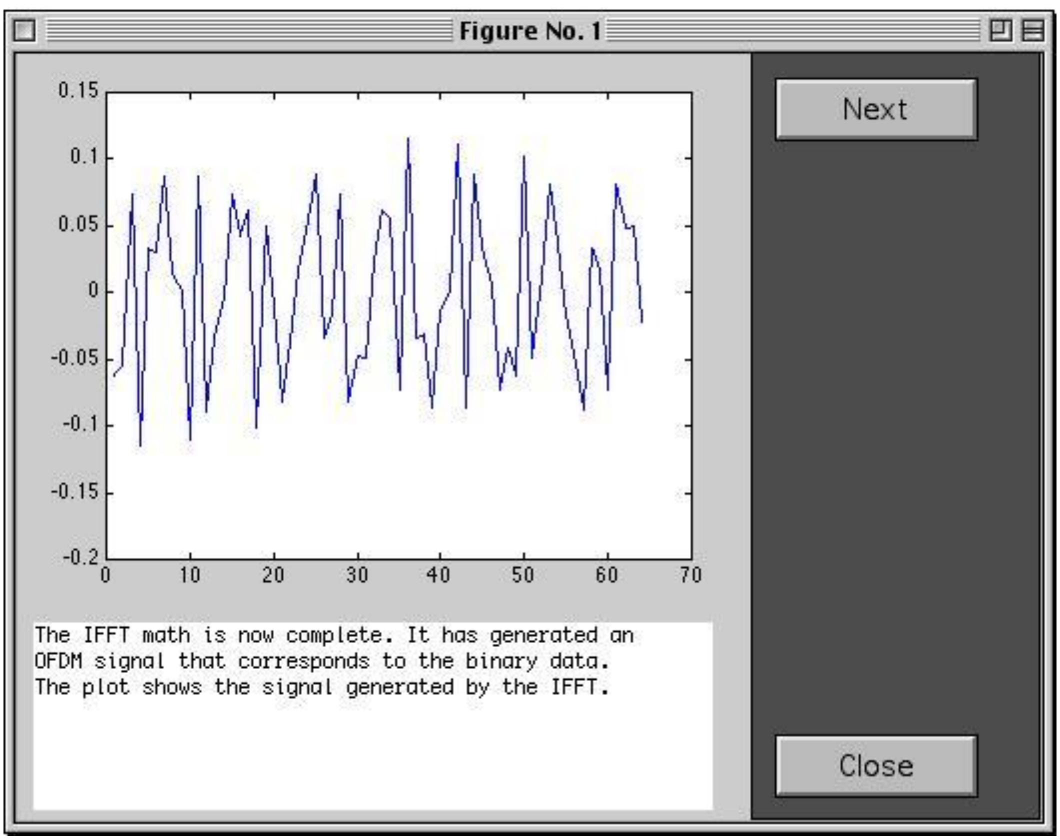


Figure No. 1
Next
Close
The IFFT math is now complete. It has generated an OFDM signal that corresponds to the binary data. The plot shows the signal generated by the IFFT.

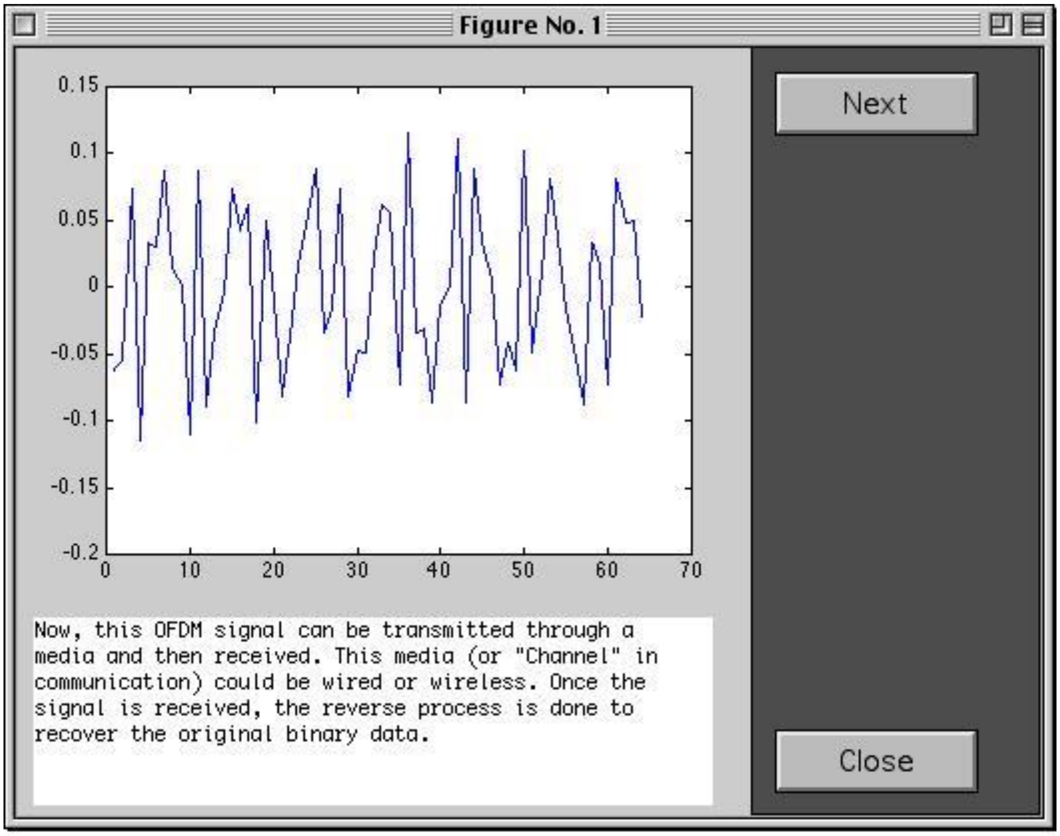


Figure No. 1
Next
Close
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0
10
20
30
40
50
60
70
Now, this OFDM signal can be transmitted through a media and then received. This media (or "Channel" in communication) could be wired or wireless. Once the signal is received, the reverse process is done to recover the original binary data.

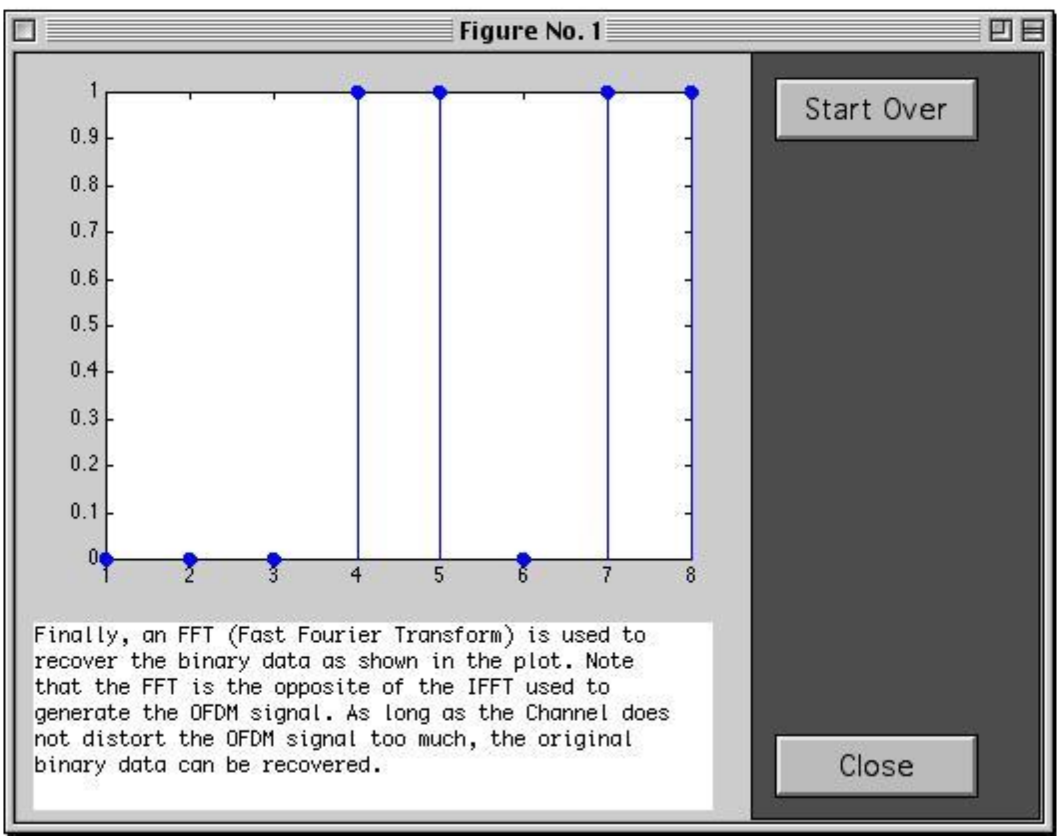
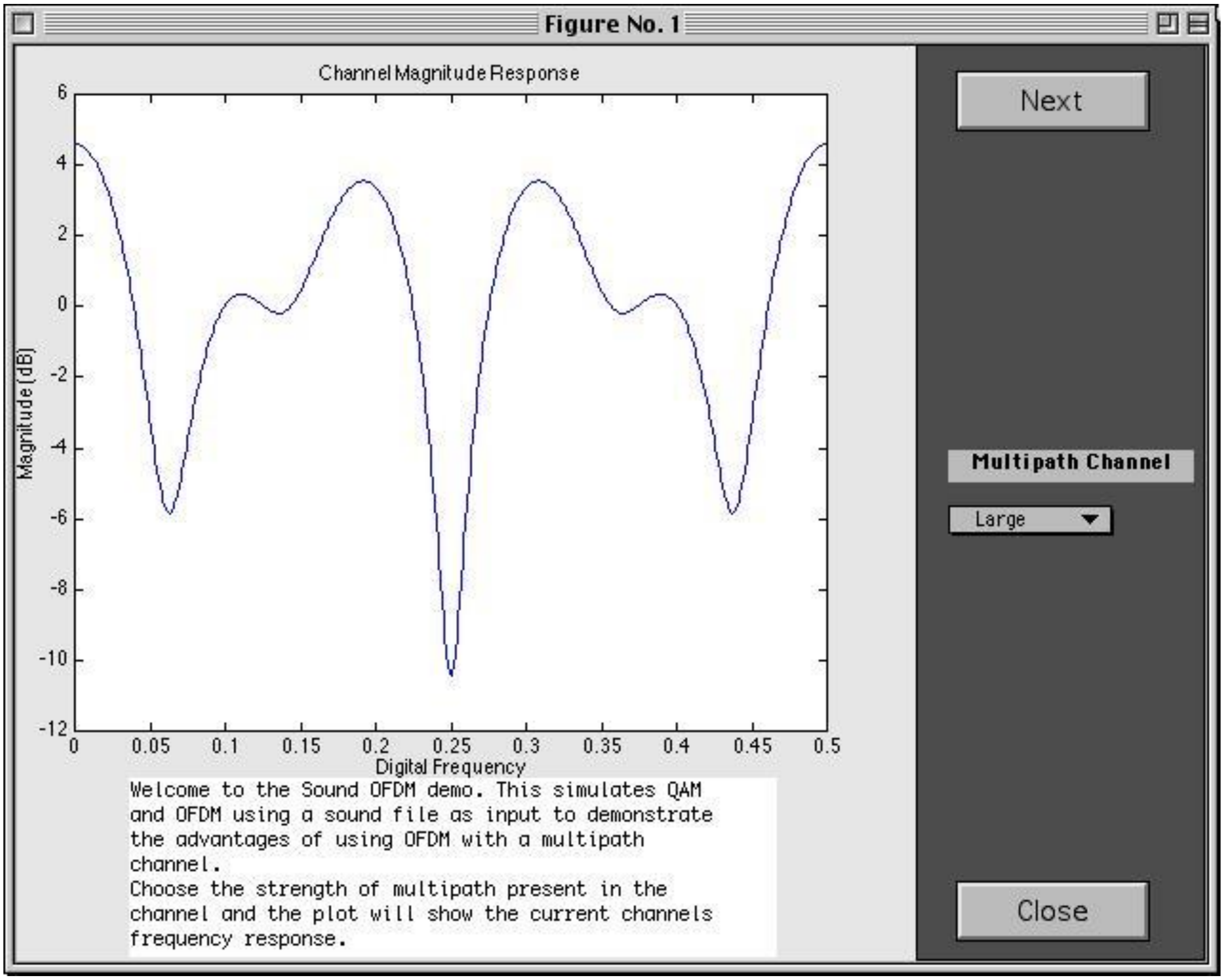


Figure No. 1
Start Over
Close
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
Finally, an FFT (Fast Fourier Transform) is used to recover the binary data as shown in the plot. Note that the FFT is the opposite of the IFFT used to generate the OFDM signal. As long as the Channel does not distort the OFDM signal too much, the original binary data can be recovered.

The second demonstration, soundgui (or soundgui_win), gives a more technical example. It compares OFDM to 16-QAM in a multipath channel. The user can choose no, small, or large amount of multipath. The following screenshots show the demo sequence with explanations in the text box.



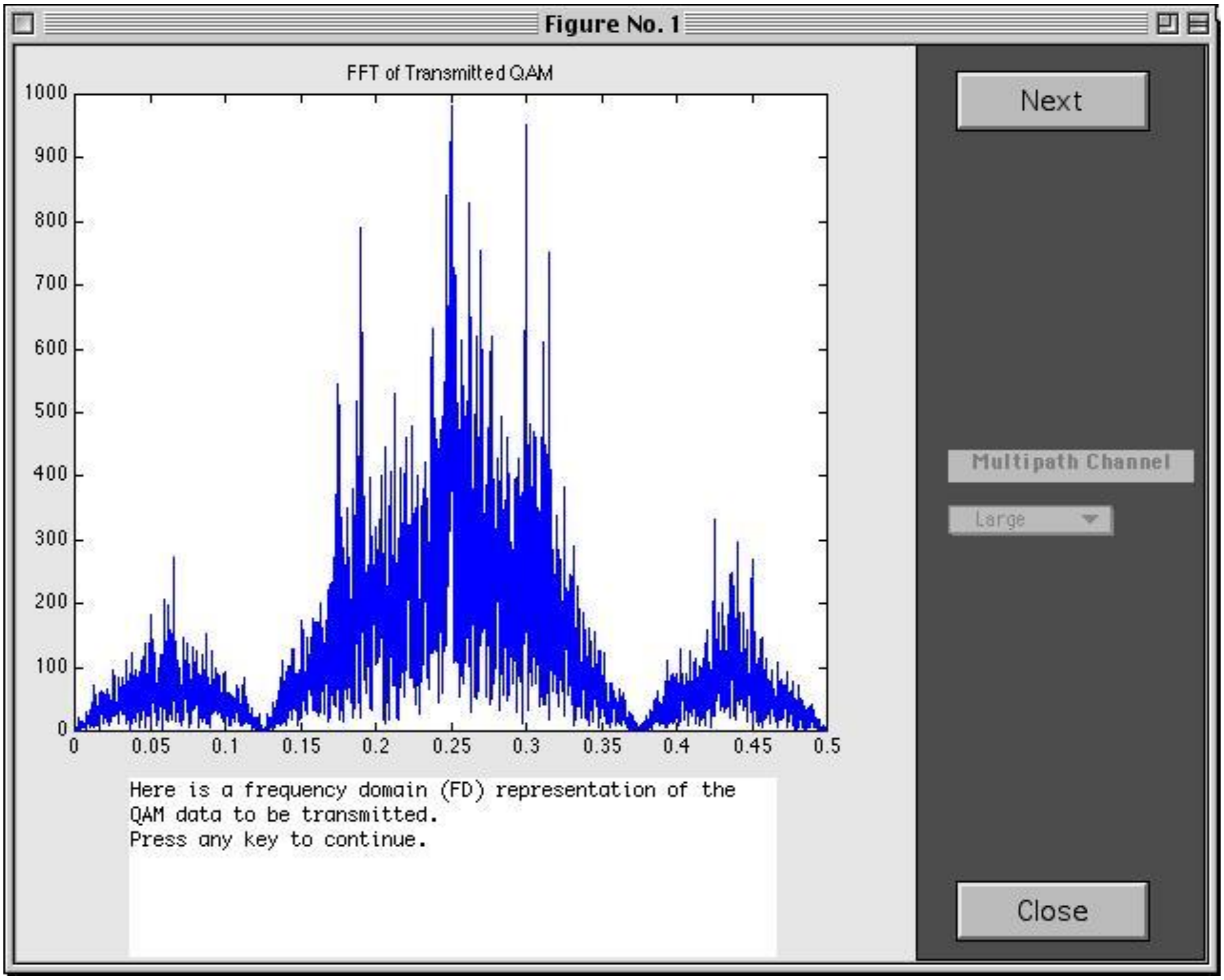


Figure No. 1
FFT of Transmitted QAM
1000
900
800
700
600
500
400
300
200
100
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Here is a frequency domain (FD) representation of the
QAM data to be transmitted.
Press any key to continue.
Next
Multipath Channel
Large
Close

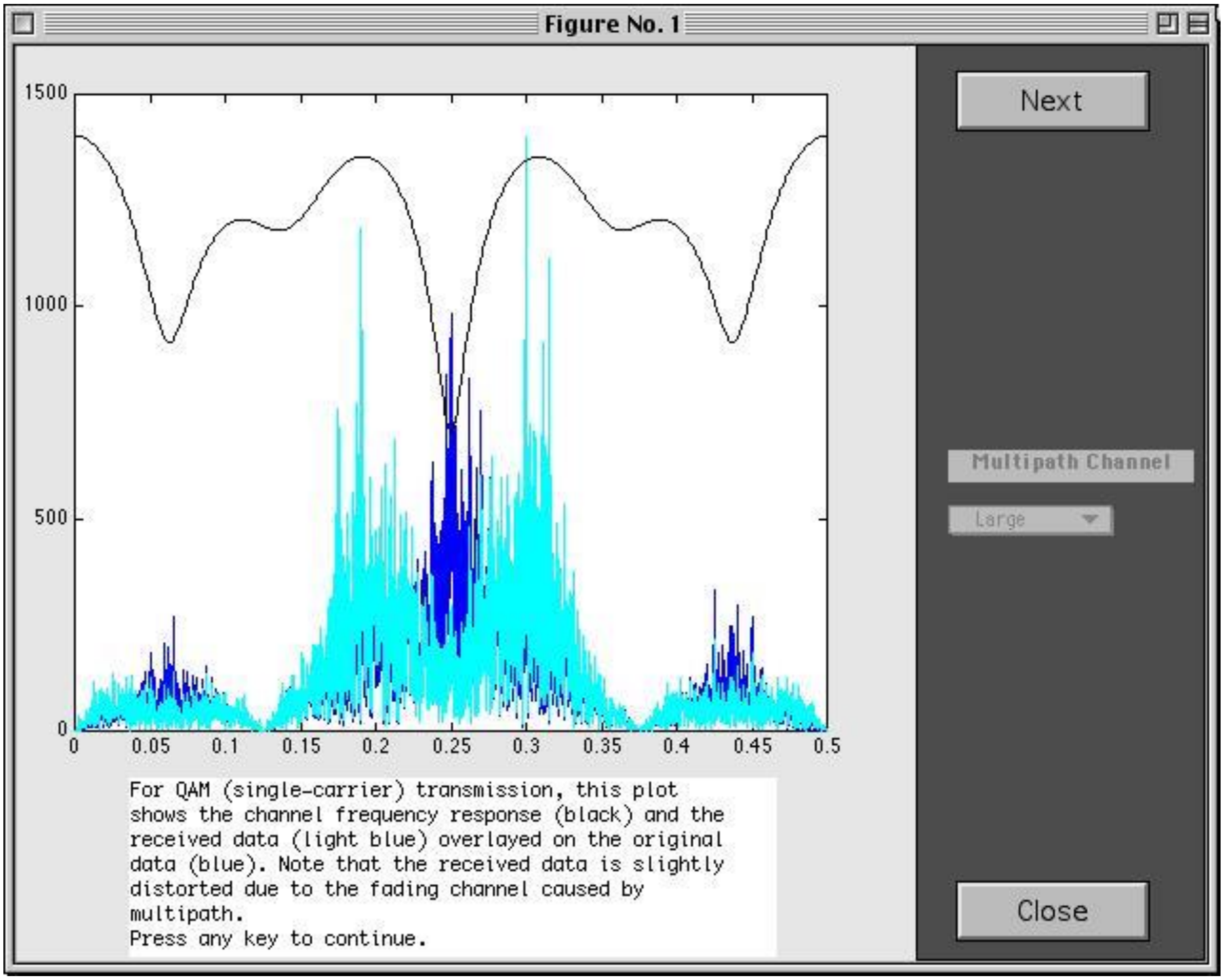


Figure No. 1
Next
Multipath Channel
Large
Close
1500
1000
500
0
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5
For QAM (single-carrier) transmission, this plot shows the channel frequency response (black) and the received data (light blue) overlayed on the original data (blue). Note that the received data is slightly distorted due to the fading channel caused by multipath.
Press any key to continue.

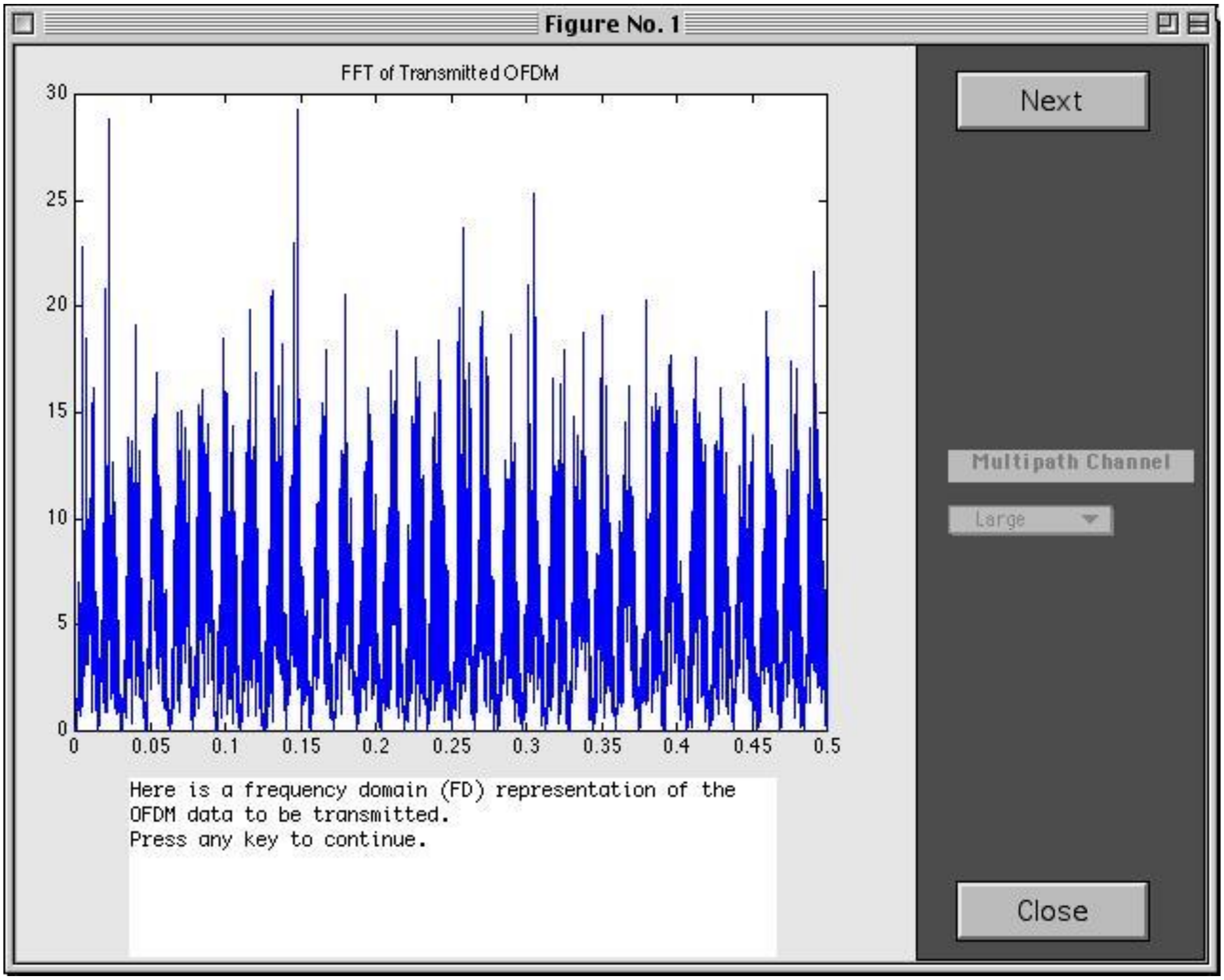


Figure No. 1
FFT of Transmitted OFDM
30
25
20
15
10
5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Here is a frequency domain (FD) representation of the
OFDM data to be transmitted.
Press any key to continue.
Next
Multipath Channel
Large
Close

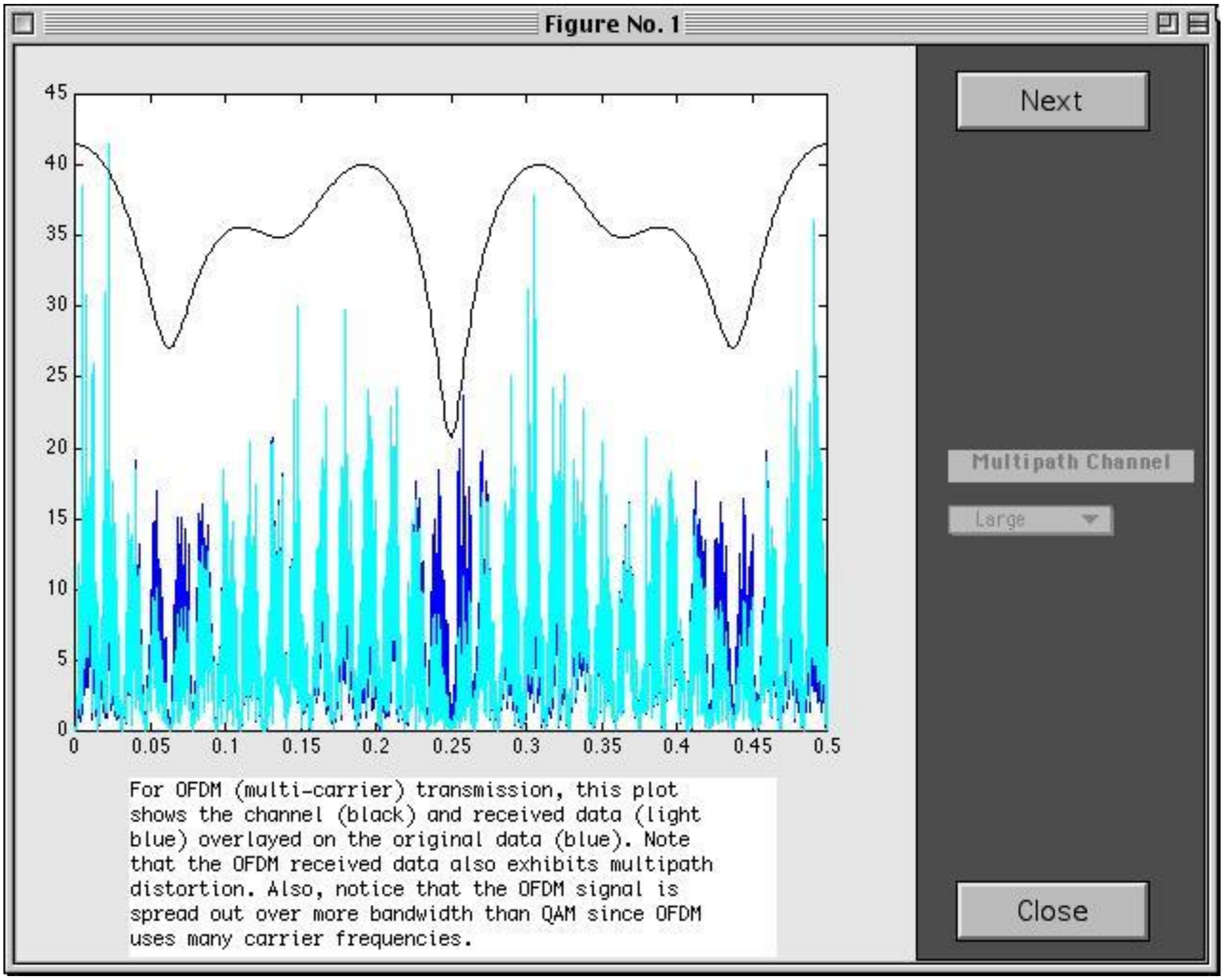
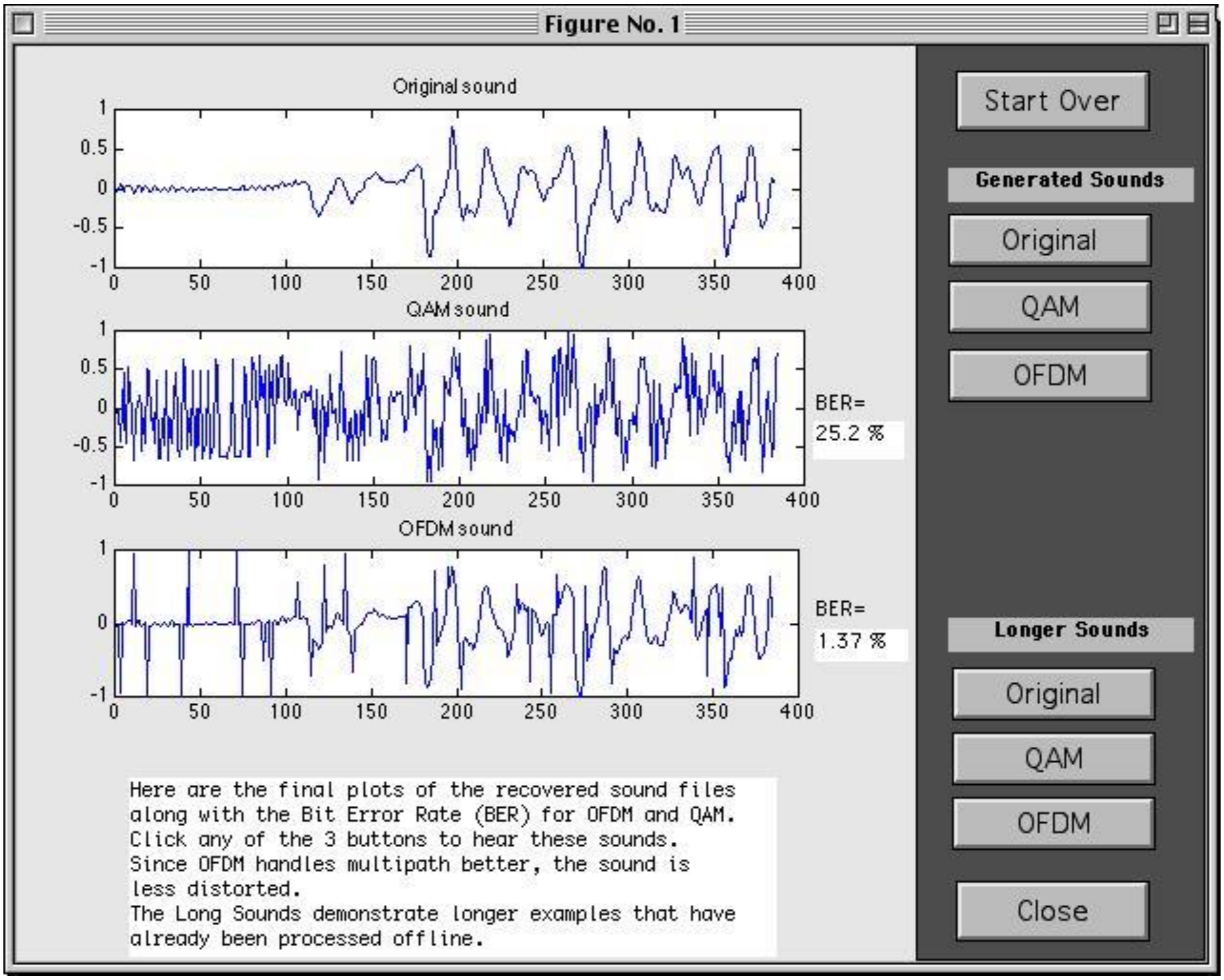


Figure No. 1
Next
Multipath Channel
Large
Close
45
40
35
30
25
20
15
10
5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
For OFDM (multi-carrier) transmission, this plot shows the channel (black) and received data (light blue) overlayed on the original data (blue). Note that the OFDM received data also exhibits multipath distortion. Also, notice that the OFDM signal is spread out over more bandwidth than QAM since OFDM uses many carrier frequencies.



The two GUI demonstrations utilize the complete simulation code, but not all of its capabilities. By modifying the setup.m m-file, users can adjust parameters such as the fft_size, num_carriers, input types, and channel characteristics. It also allows detailed analysis of the communication system. Plots showing OFDM input and output, 16-QAM input and output, and the received 16-QAM signal constellation are generated. See Figures 5, 6, and 7 for examples of these plots.

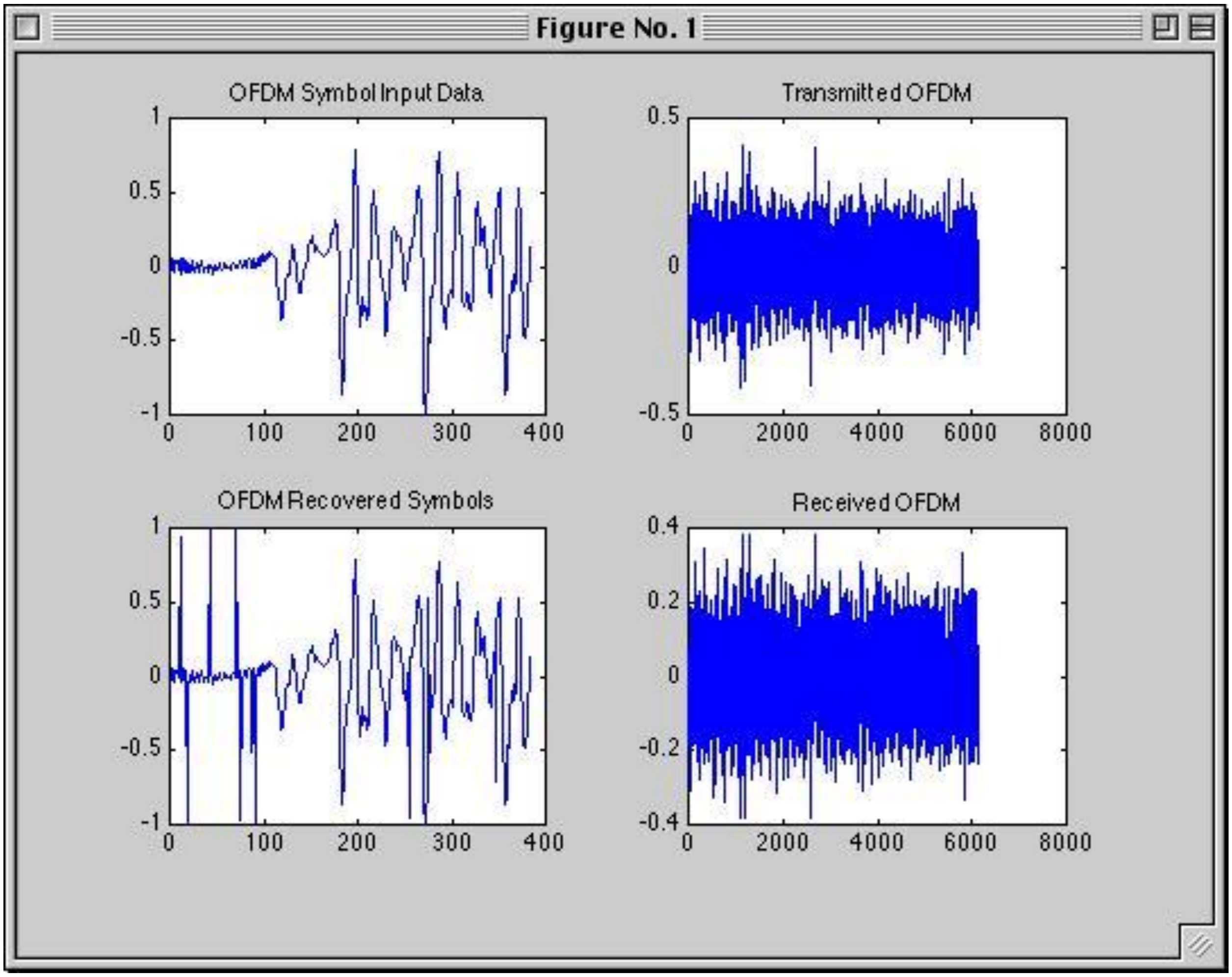


Figure 5: OFDM Input and Output

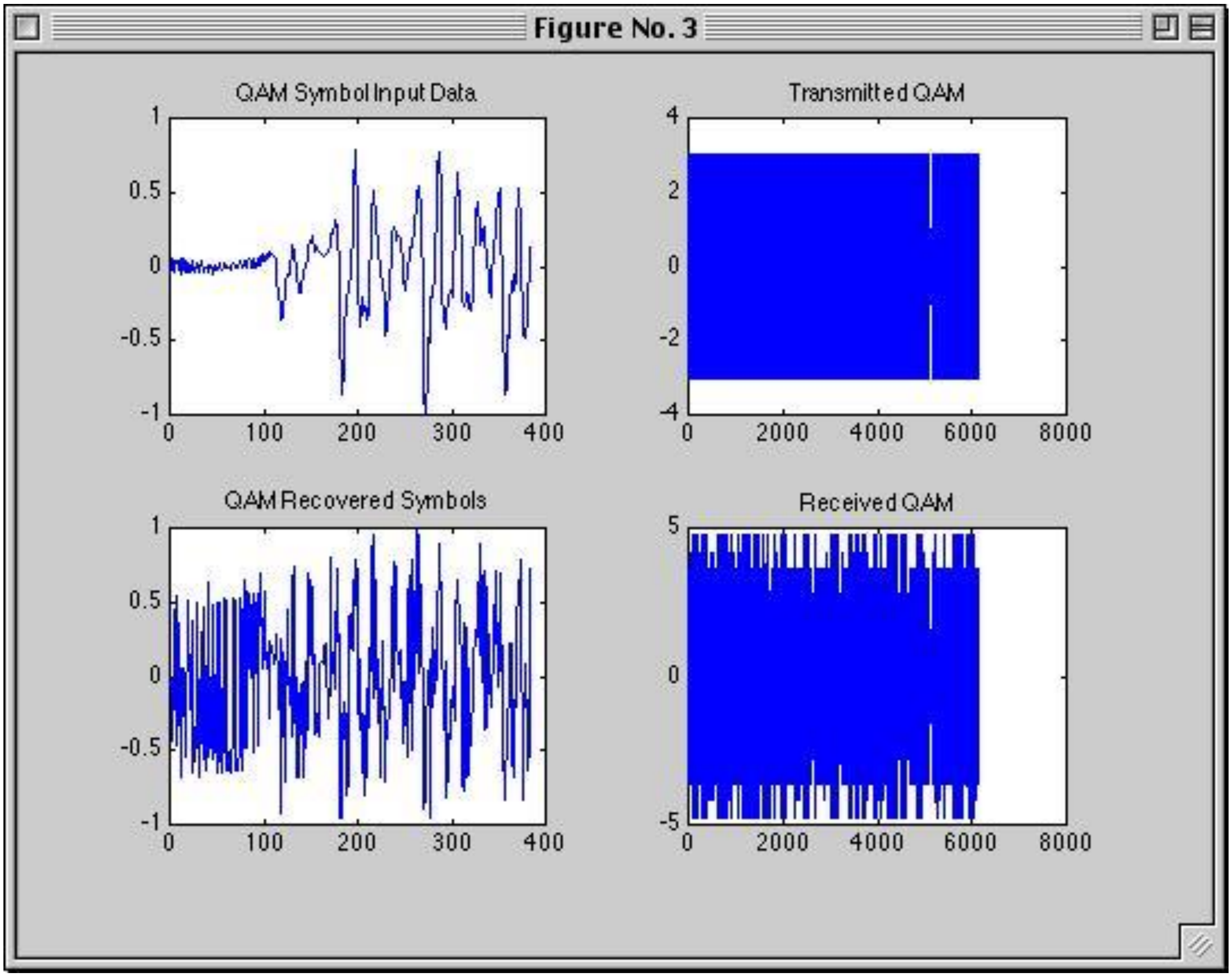


Figure 6: 16-QAM Input and Output

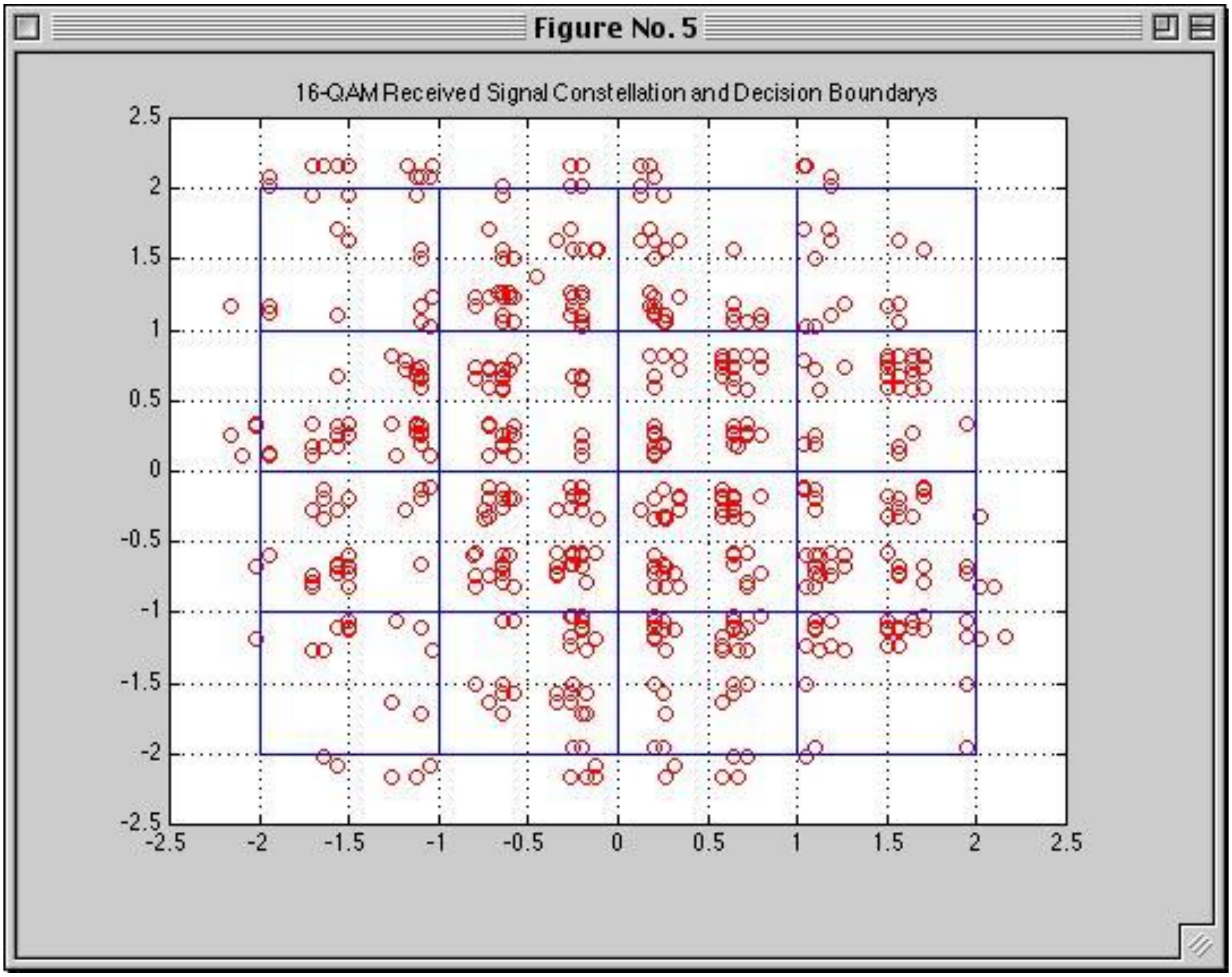


Figure 7: Received 16-QAM Signal Constellation

Depending on the input type chosen, appropriate output files are created. This enhances the numerical error analysis by showing how the errors degrade the data being transmitted. For one test, the preamble of the US constitution was transmitted. Figure 8 shows the results.

The Original Data	*OFDM transmission* *Bit Error Rate = 0.0699%* *Binary Errors = 4*	*16-QAM transmission* *Bit Error Rate = 23.0%* *Binary Errors = 1,315*
IN CONGRESS, July 4, 1776.	IN CONGRESS, July 4, 1776.	JO$ìè__BÜSÉ\4õtl8$x<4tz*). ___x u$¥n!Æ)m/$rTïucú1±°¥yo_$ø _$¥
The unanimous Declaration of the thirteen united States of America,	The unanimous Declaration of the thirteen united States of America,	xu$¥xyq¥uen$¥n)tud4£§q¥ur Tø_$ í□%q©cël___Xun$ □n$¥xu$ìü$q□ï $ø_$□tm!Æ$µuen4r\4 □t4□•cü_%r
When in the Course of human events, it becomes necessary for	When in the Course of human events, it becomes necessary for	Tæ%cïr¢ë± □$□o!dø_%_0µo º5$¥ _¥yr¢ü_5e$¥xu$ □ø_9tycë¨4
one people to dissolve the political bands which have connected them	one people to dissolve the political baods which have connected thel	□°Æ$rT□Xycò4 □qµe$ □ü_.%c§ud 4¥xum_6Ytx4±Æ/$xuql4±Æ$ 4¥
with another, and to assume among	with another, and to assume among	_± □ ¢§m%$± □ /_'_¥xu$□ ø&Uq□ Tø
the powers of the earth, the separate and equal station to which	the powers of the earth, the separate and equal station to which	_$¥xu$µa±¥x<4¥xu_2ïp±±°¥ u$± Æ$4µp¥a¨4 □§q¥yo_$¥ _ □Xycò4¥
the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.	the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.	xu$ù1 □bTø_$ü!¥tq•$±Æ$4ø___!¥t q•+bTó__4µn4yt\|5$¥xum,4±d ¥ucï n44±•r†µc§4¥ _¥xu$ø □n)o_2Tø__- !Æ+Yn$4±•p¥iq•rT¥xq¥4¥xu x$ □ò $l44¥ucú1±•$¥xu$ □ë¥rïrT□Xycò 4□m0µl_4xum$¥ _¥xu$ □ïp±±°¥y
We hold these truths to be self- evident, that all men are created	We hold these truÙ hs to be self- evident, that all meo are created	o_.___U$□ _44¥xurï$¥q¥txrT¥ _□•$□ïl6
equal, that they are endowed by	equal, that they are endowed by	%uidun4<4¥xq¥4±¨<4 □ %n$±±•$ □
their Creator with certain unalienable Rights, that among	their Creator with certain unalienable Rights, that	°•a¥ud_%p¥a¨<4¥xq¥4¥xux$ ±±•$ µn$ &Ud4 □□$¥xuiqdì°•a¥

these are Life, Liberty and the pursuit of Happiness.	among these are Life, Liberty and the pursuit of Happiness.	!d □Y tx4□ïq¥q©n$¥n!¨9en!¢¨5__© gXtr\ 4¥xq¥4± □/_'_¥xurï$±±•$ù9fe,4ù9b •q¥x$±Æ$4¥xu$ □¥q□§it4ø_$ôq □ □ □n%r¢^_f

Figure 8: Text Example Comparing OFDM to 16-QAM

OFDM transmission had a very low bit error rate of 0.0699% so only four errors were caused by the multipath channel. 16-QAM incurred a 23.0% bit error rate. Since a character is represented by eight bits, every character had two bits in error on average. This resulted in unintelligible received text.

A second test using an audio file produced similar results. The difference is that users can see and hear the degradation caused by binary errors. Figure 9 shows plots of the audio files.

The Original Sound	*OFDM transmission* *Bit Error Rate = 0.01%* *Binary Errors = 17*	*16-QAM transmission* *Bit Error Rate = 21.2%* *Binary Errors = 35,957*

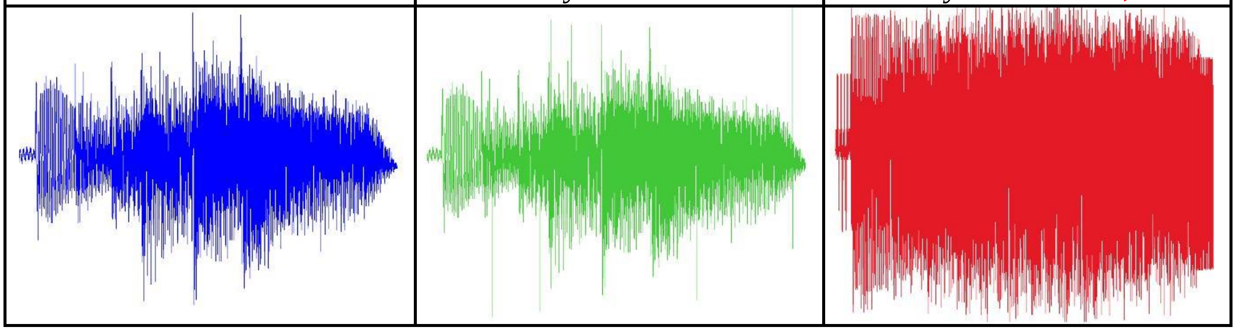


Figure 9: Audio Example Comparing OFDM to 16-QAM

In this case, the original sound is a guitar plucking a chord. The OFDM sound contains audible "clicks" due to bit errors and the waveform is similar to that of the original sound. The 16-QAM sound's waveform does not resemble the original and listening to the 16-QAM sound confirms this. The original guitar chord is barely discernable underneath loud static noise.

Conclusion

This MATLAB simulation proves that OFDM is better suited to a multipath channel than a single carrier transmission technique such as 16-QAM. This program is available on the Bradley University Electrical Engineering Department web page at http://cegt201.bradley.edu/projects/proj2001/ofdmabsh/.

Future research may be based on this project. These extensions may include channel phase shift detection and correction, error correction by coding, adaptive transmission, peak to average power ratio considerations, and DSP implementation.

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Z. Lawrey, Eric. OFDM Wireless Technology. 11 May 2000. 7 Nov. 000. http://www.eng.jcu.edu.au/eric/thesis/Thesis.htm

FUNDED/ UNFUNDED PROPOSALS:

The proposal for Two Weeks Embedded Systems Faculty Development Programme (FDP) under AICTE grants is applied and waiting for its approval.

OBJECTIVE:

The proposals for AICTE grants like UGC grants, DST CPRI and other funding agencies by giving Title and abstract/objective OR Self Funded program proposals may be submitted for Management approvals.

Proposal for Seminar Grant:

TITLE: Seminar on Hardware Design Of DSP Systems

OBJECTIVE: This seminar is intended to bring down the awareness among students and staff in order to study the hardware design of DSP systems.

13. PROPOSALS (WEEK WISE INDUSTRIAL VISITS) (IN HOUSE OR OUTSIDE VISIT)/TRAINING PROGRAMMES:

TABLE 1: INDUSTRIAL VISITS

As of now no industrial visits is proposed.

S. No	Type of industry	Nature of industry	Date of visit	No. of students participated	Year/branch	Remarks
1	**Dsp Group,Inc**	TeakDSPCore, D6000 Family ICs	**20-1-2015**	**90**	**III-II ECE**	
2	**DRS Technologies**	ICs like Cheetah PMC	**25-2-15**	**90**	**III-II ECE**	

TABLE 2: INDUSTRIAL TRAINING (Shadow Engineering) (Career Visit Approval)

Three day training on Custom IC design using 45 nm technologies is proposed at CDAC, Hyderabad.

S.No	Name of the Course	Nature of industry	Duration of Training	Authority	Date of Training/Certificate No.	Remarks

GUIDELINES FOR SHADOW ENGINEERING (VIP)

INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM):

OBJECTIVES OF SHADOW ENGINEERING:

1. The program which uplifts the knowledge of the students related to laboratories.
2. To improve the industry-college interactions.
3. To create industry like environment for all the students in order to make future assignments.
4. This program leads to matrixing with the students.

14. CALIBRATION/INSTALLATION AND TESTING:

CALIBRATION: Aim of this concept is to check,

iv. Whether all the equipment is functioning correctly as per the standards
v. To bring correctness in the errors of instrument or equipment
vi. To rectify the errors if any

INSTALLATION: Aim of this concept is to make and maintain installation procedure for a new equipment or already existing equipment.

TESTING: Aim of this concept is to test the equipment after installation whether it meets the existing standards.

Case 1: Calibration of Equipment

S.No	Type of equipment	Certificate No	Certificate issued by	Date of calibration	Date of calibration due	Remarks

Procedure for Installation:

Mat lab Installation:

STEPS**:** Installation of MATLAB Software for window XP/VISTA / Windows 7/8
Get administrator privileges for the system on which you plan to install MATLAB.
Use WinRAR to extract RAR file

Step1: Start the installer for Windows, double-clicking on setup.exe

Step 2: Choose to Install Without Using the Internet
When it starts, the installer displays the following dialog box. Select the Install without using the Internet option and Click OK to proceed with installation.

Step 3: Review the License Agreement

Review the software licensing agreement and, if you agree to its terms, click Yes.

Step 4: Enter the File Installation Key
Enter your File Installation Key and Click OK.

Step 5: Choose the Installation Type
In the Installation Type dialog box, specify whether you want to perform a Custom Installation and click next.

Step 6: Specify the Installation Folder Specify the name of the folder where you want to install MathWorks products. Accept the default installation folder or click Browse to select a different one. If the folder doesn't exist, the installer creates it.

Step 7: Specify Products to Install (Custom Only)
Leave it by default and continue.

Step 8: Specify the Location of the License File.
Enter the full path of your License File in the text box (or drag and drop the file) and Click Next.

Step 9: Specify Installation Options (Custom Only)
After selecting installation options, click next to proceed with the installation.

Step 10: Confirm Your Choices and Begin Copying Files
Before it begins copying files to your hard disk, the installer displays a summary of your installation choices. To change a setting, click back. To proceed with the Installation, click Install. As it copies files to your hard drive, the installer displays a status dialog box to show the progress of the installation.

Step 11: Complete the Installation.

Case 3: Testing of Equipment

15. MAINTAINANCE AND TROUBLESHOOTING:

(A)TROUBLE SHOOTING SCHEDULES:

(A)Maintenance:

Maintenance and trouble shooting of equipment in a laboratory must follow the following guidelines:

Maintenance Schedules:

(1) Preventive Maintenance Schedules of lab will be decided by lab in charge along with concerned HOD. The details of schedule should be recorded in the following template of format.

S. No.	Name of the Equipment	Date of Maintenance	Type of Activity	Remarks
1	DSP kit		Checking of working	

(2) Maintenance Reports duly signed by in charges as well as HODs and duly approved by Principal periodically.

(B) TROUBLE SHOOTING SCHEDULES:

A proposal is to be made from each lab branch wise. The proposal should carry following details related to specific equipment in lab.

S. No., Equipment Name , Type of Problem (Too much Noise, Abnormal Sound, Corrupt Software, Anti Virus Problem, Missing of Display, CRT not working, Motor is not giving signal, Digital display is not working, Break of tools, Misalignment of machine elements, PLC is not properly working), Expected Reasons (Bearing failure, Improper alignment of machine centre, Missing of vibration pads etc)

Trouble shooting exercises should be properly recorded in a separate format as mentioned below:

S. No	Date of recording activity	Equipment Name	Type of Trouble	Remedial Activity	Remarks
1		TMS320C6713 Processor kit	Led not glowing	Changing that LED.	

16. ASSESSMENT AND ACCREDITATION PROCESDURE AS PER NABL

Accreditation is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to carry out the tasks. It provides the feedback to laboratories as to whether they are performing according to technical competence as per guidelines of NABL (National Accreditation Board for Testing and Calibration Laboratories)

The laboratory should carry out the following important tasks towards getting ready for accreditation from NABL.

16. Preparation of methodology in each experiment
17. Preparation of Standard Operating procedure for each equipment
18. Preparation of Laboratory Manual as per the guidelines specified by Combined Lab Team(CLT) headed by Principal/HOD/Dean/incharge
19. Ensure Effective environmental conditions (temperature, humidity,storage and placement) in the laboratories by implementing proper housekeeping and cleaning of the equipments from dust, dirt etc.
20. Ensure Calibration of instruments/equipment(Only NABL accredited authorized laboratories provide calibration.
21. All the details of Calibration should be included in the format specified exclusively for calibration procedure.
22. Ensure proper implementation of all the documents, formats to be included in the lab manual.
23. Impart training for all the technicians working in labs about the importance of documentation, log sheets, operating procedure of the lab.
24. Incorporate Internal Lab audits for effective functioning of the laboratories. Audits may be once in a month or 3 months or at the end of the semester. The audit schedule will be decided by the Chairman and Principal of the CLT team.

25. Auditors should submit the detailed report of each lab duly signed to the Principal.
26. Each lab should maintain all the bills/invoices of each instrument or equipment in a separate file.
27. All the stock registers either consumable or non consumable should be updated whenever any purchases of consumables or equipment takes place.
28. All the safety precautions are properly displayed in front of each lab.
29. All the Lead experiments should be maintained separately in a record /record in a separate folder.
30. Based on Pre Assessment report submitted by auditor, corrective actions should be carried out by each lab in charge and that must be forwarded to concerned HOD and Principal.

SUBJECT WISE LAB PLANNER

NAME OF THE SUBJECT: ADVANCED COMMUNICATION SKILLS LAB

(III YEAR)

CONTENTS:

1. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

To improve students’ fluency in spoken English

To enable them to listen to English spoken at normal conversational speed

To help students develop their vocabulary

To read and comprehend texts in different contexts
To communicate their ideas relevantly and coherently in writing
To make students industry-ready
To help students acquire behavioral skills for their personal and professional life
To respond appropriately in different socio-cultural and professional contexts

2. SCOPE:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

3. PRE REQUISITES:

Basic knowledge of English grammar
Use of Parts of speech, basic sentence pattern and tense of English vocabulary
Ability to write forms
Basic understanding simple and good English
Have interest to learn the language
Course Outcomes
Students will be able to:
Acquire vocabulary and use it contextually
Listen and speak effectively
Develop proficiency in academic reading and writing
Increase possibilities of job prospects
Communicate confidently in formal and informal contexts

Course Outcomes

Students will be able to:

- Acquire vocabulary and use it contextually
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- Increase possibilities of job prospects
- Communicate confidently in formal and informal contexts

LISTENING SKILLS:

Objectives

- To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
- To equip students with necessary training in listening so that can comprehend the speech of people of different backgrounds and regions

SPEAKING SKILLS

Objectives:

- To make students aware of the role of speaking in English and its contribution to their success
- To enable students to express themselves fluently and appropriately in social and professional contexts

READING SKILLS

Objectives:

- To develop an awareness in the students about the significance of silent reading and comprehension
- To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

WRITING SKILLS

Objectives:

- To develop awareness among the students about writing as an exact and formal skill.
- To equip them with the components of different forms of writing, beginning with the lower order ones

4. SYLLABUS:

The following course contentto conduct the activities is prescribed for the advanced Communication Skills (ACS) Lab:

UNIT – I

Activities on Fundamentals of Inter-personal Communication and Building Vocabulary

Starting a conversation - Responding appropriately and relevantly - Using the right body language - Role Play in different situations & Discourse Skills using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

UNIT – II

Activities on Reading Comprehension

General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective goggling.

UNIT – III

Activities on Writing Skills

Structure and presentation of different types of writing - letter writing/ Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing - planning for writing - improving one's writing.

UNIT – IV

Activities on Presentation Skills

Oral Presentations (Individual and Group) through JAM Sessions/Seminars/PPTs and Written presentations through Posters/ Projects/ Reports/ E-mails/ Assignments etc.

UNIT – V

Activities on Group Discussion and Interview Skills

Dynamics of Group Discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through Tele-conference & Video-conference and Mock Interviews.

5. LEAD EXPERIMENT

- I. Speaking skills as part of BEC Exam

- Volume
- Clarity
- Variety: Pace, Pitch - Inflection – Emphasis, Pause
- II. Technology-based Communication:
- Etiquettes: effective e-mail messages
- power-point presentation
- Non-verbal Communication and Body Language
- Forms of non-verbal communication Interpreting
- body-language cues
- **ACS lab is divided into 2 parts**
    - CALL Lab : Computer assisted language learning lab
    - ICS Lab: Interactive communication skills lab

ACS LAB (CALL LAB)

List of experiments:

1. Vocabulary Building: Synonyms, Antonyms, Word Roots, One-Word Substitutes, Prefixes, Suffixes, Word Origin, Business Vocabulary, Analogy, Idioms and Phrases, Collocations & Usage Of Vocabulary
2. Exercises on Reading Comprehension.
3. Activities on Writing Skills – Sample letters, Cover letter, Resume writing
4. Activities on Writing Skills – E- Correspondence, Report Writing, Portfolio Writing
5. Oral Presentations
6. Written Presentations
7. Interpersonal Communication: Conversational Techniques and Practice.
8. Dynamics of Group Discussion
9. Group Discussion Sessions
10. Interview Skills and Mock Interview

Practical Oriented Questions for Practice and Viva

Role Play Topics Conversation between:

- A Doctor & a Patient
- Principal & a Student
- Customer & a Shopkeeper
- a Customer & a hotel Receptionist

Topics for Oral Presentation (Extempore) Speaking:

1. Fresher’s Parties
2. Co-education
3. Reality Shows
4. Influence of TV on kids
5. Social networking sites

TOPICS FOR JAM SESSION:

1. Language Labs: Are they useful?
2. Using mobiles while driving
3. Teenage: Enjoyment
4. My role model
5. If not an Engineer, I would be……

INTERVIEW QUESTIONS:

1. Tell me something about yourself.
2. What are your career options right now?
3. Give me an example of your creativity**.**

TOPICS FOR GROUP DISCUSSION:

1. Is our Political System Reason for our Backwardness?
2. Do we really Need Education to be Successful?
3. Women Empowerment - A Cause for Increasing Divorce Rate in India

Advance communication skills lab Evaluation

- INTERNAL EXAM -25 M
- Day-to-day evaluation -15 M
- Written Test(s)-10 M
- EXTERNAL EXAM – 75 M
- Write up -20M
- Day-to-day evaluation-15M
- Activity-15M
- Record – 10M
- Viva – 15M

Total – 100 M

7. SUGGESTED BOOKS

Practical Lab Manual: A book entitled**:** A Course Book of Advanced Communication Skills (ACS) Lab published by University Press, Hyderabad.

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

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

8. WEBSITES (USEFUL LINKS)

SPEAKING

- EL Easton Pronunciation (http://evaeaston.com/)
- 10 Tips for Successful Public Speaking from Toastmasters (http://www.toastmasters.org/MainMenuCategories/FreeResources/Nee
- dHelpGivingaSpeech/TipsTechniques/10TipsforPublicSpeaking.aspx)
- Allyn & Bacon Public Speaking Website (http://wps.ablongman.com/ab_public_speaking_2/)

READING

- Bartleby.com (http://www.bartleby.com/)
- The Magazine Rack (http://www.magatopia.com/
- Reader's Digest Magazine Articles (http://www.rd.com/
- Reading Skills(Using a Dictionary, Finding Main Ideas, Drawing Inferences, more from the AmLa Department of Mt. San Antonio College)
- (http://vclass.mtsac.edu/amla-51/Skills%20Exercises/homework.htm)

WRITING

- Writing Tips: Sentence Builder (http://www2.actden.com/writ_den/tips/sentence/index.htm)
- Writing Tips: Paragraphs (http://www2.actden.com/writ_den/tips/paragrap/index.htm)
- Writing Tips: Essays (http://www2.actden.com/writ_den/tips/essay/index.htm)
- Letter Writing Desk (examples, samples, tips, formats)
- (http://jobsearchtech.about.com/library/bl-business-letters.htm)
- VIRITUAL LABS REFERENCE LINKS
  https://www.englishlab.co.in/
  https://ve-iitg.vlabs.ac.in/
  https://www.pearson.com/english/myenglishlab.html
  https://www.tataclassedge.com/digital-classrooms-learning/english-lab/
  https://www.tataclassedge.com/digital-classrooms-learning/english-lab/

SUGGESTED SOFTWARE

The Software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech
- TOEFL & GRE(KAPLAN,AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

9. EXPERT DETAILS

- Kummaravadivelu
- Professor in Applied Linguistics San Jose State University, U.S.A

- Dr. Janina Kahn-Horwitz
- Professor in English Language Education Oranim Academic college
- of education Israel
- NATIONAL EXPERTS:
- Prof. Paul Gunashekar
- Dean School of English Language Education EFL University – Hyderabad.
- REGIONAL EXPERTS:
- Dr. Paravathi Vudumula
- Professor in English JNTUH.

SUBJECT WISE LAB PLANNER
NAME OF THE SUBJECT: MICROWAVE AND OPTICAL COMMUNICATIONS LAB

CONTENTS:

1. OBJECTIVE AND RELEVANCE

The main objective of this lab is to gain the practical hands on experience by exposing the students to various microwave bench setups and microwave components. And also understanding of the concepts involved in microwave signal generation, transmission and reception in microwave communication. Even the latest trend of communication technology i.e fiber optics is also introduced and propagation conditions will be verified by evaluating the losses.

2. SCOPE

Understanding of Microwave and optical communications lab has the scope to make the learner comfortable to work in the communication area. This subject gives us an idea or overview to learn concepts of microwave as well as optical communications engineering.

3. PREREQUISITES

Knowledge of microwave components propagation of wave concepts optical fiber link and the operation of CRO is required. This lab recommends complete practice of microwave components and devices and optical communications kits.

1. SYLLABUS AS PER JNTUH

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation measurement
4. Directional coupler Characteristics.
5. Scattering parameters of wave guide components
6. Frequency measurement.
7. Impedance measurement
8. VSWR measurement
9. Characterization of LED.
10. Characterization of Laser Diode.
11. Intensity modulation of Laser output through an optical fiber.
12. Measurement of Data rate for Digital Optical link.
13. Measurement of Numerical Aperture of fiber cable.
14. Measurement of losses for Optical link

Equipment required for Laboratories:

1. CRO - 0 – 20 M Hz.
2. Microwave Test bench

3. Microwave Components
4. SWR Meter
5. Cooling Fan
6. Optical Trainer Kits
7. Multi meters
8 Optical cables like 1m, 2m, 5m, RS 230 Cables etc
9. Patch Chords
10. BNC Cables

MAIN LINKAGE OF MWE THEORY WITH LAB EXPERIMENTS OF MWE MWE LAB

MW& OC LAB
EXPERIMENT NO 1:
Characteristics of the Reflex Klystron Tube.

OBJECTIVE
To study the characteristics of the Reflex Klystron Tube.

PREREQUISITES
Basic knowledge about Reflex Klystron Tube.

DESCRIPTION
a. Demonstration about experiment -30min
b. Connecting microwave components which are required.
c. Observing the Frequency characteristics of Reflex Klystron Tube

APPLICATIONS
1. Satellite Communications
2. Radar Communications

EXPERIMENT NO 2:
Study V-I characteristics of Gunn Diode

OBJECTIVE:
To study V-I characteristics of Gunn Diode

PREREQUISITES
Basic knowledge about Gunn Diode

DESCRIPTION
a. Demonstration about experiment
b. Connecting microwave components which are required.
c. Observing the Characteristics of Gunn Diode.

APPLICATIONS

1. Satellite Communications
2. Radar Communications

EXPERIMENT NO 3:

Measurement of attenuation for given wave guide.

OBJECTIVE:

To measure the attenuation introduced by the given wave guide.

PREREQUISITES

Basic knowledge of electromagnetic wave theory.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Connection of experiment and its verifications

c. Experimental determination

d. Mathematical calculations to find attenuation

APPLICATIONS:

1. Variable and fixed attenuation measurement of the signal.

EXPERIMENT NO 4

OBJECTIVE

Study the function of multi-hole directional coupler by measuring S parameters.

PREREQUISITES

Basic knowledge about multi-hole directional coupler

DESCRIPTION

a. Demonstration about experiment

b. Connecting microwave components which are required.

c. Observing the Characteristics multi-hole directional coupler.

APPLICATIONS

Couplers are commonly used for sampling a single direction of power which is flowing through a transmission line.

EXPERIMENT NO 5:

OBJECTIVE

Measurement of Scattering Parameters of Waveguide components (E plane Tee, H plane Tee, Magic Tee and Circulator)

PREREQUISITES:

Basic knowledge about E Plane Tee, H plane Tee, Magic Tee and Circulator

DESCRIPTION

Demonstration about experiment

Connect microwave components which are required.

Observe the Scattering Matrix of E Plane Tee, H plane Tee, Magic Tee and Circulator.

APLICATIONS

E plane & H plane Tee

1. Satellite Communications
2. Radar Communications

Magic Tee

1.Used as Mixer

2.Used as Duplexer

Circulator

1. Isolator
2. Duplexer
3. Reflection amplifier

EXPERIMENT NO 6:

Measurement of frequency of a microwave source

OBJECTIVE:

To measure the frequency of a microwave source

PREREQUISITES:

Basic knowledge of electromagnetic wave theory.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Connection of experiment and its verifications

c. Measurement of microwave frequency.

APPLICATIONS:

1. Frequency measurement in communication

EXPERIMENT NO 7:

Measurement of Impedance of given load.

OBJECTIVE:

To measure the unknown impedance at the input of the given component under test.

PREREQUISITES:

Basic knowledge of electromagnetic wave theory.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Connection of experiment and its verifications

c. Experimental determination

d. Mathematical calculations to find impedance

APPLICATIONS:

The unknown terminating impedance can be determined by measuring standing wave ratio & distance of a convenient maxima or minima from the load.

EXPERIMENT NO 8:
VSWR Measurement for Matched load, Open and Short Circuit Loads

OBJECTIVE:
To Measure the VSWR (Voltage standing wave ratio) for Matched load, Open and Short Circuit Loads

PREREQUISITES:
Basic knowledge of electromagnetic wave theory.

DESCRIPTION:
a. Introduction to experiment -30 min
b. Connection of experiment and its verifications
c. Experimental determination of VSWR meter.
d. Mathematical calculations to find VSWR

APPLICATIONS:
1.Cellular communication
2.wifi communication

EXPERIMENT NO 9:
Characterization of LED.

OBJECTIVE:
To study relationship between the LED dc forward current and the LED optical power output & to determine the linearity of the device at 660 nm and 850nm
PREREQUISITES:
Basic knowledge of optical communication.

DESCRIPTION:
a. Introduction to experiment -30 min
b. Connection of experiment and its verifications
c. Experimental determination of VSWR meter.
d. Mathematical calculations to find VSWR

EXPERIMENT NO 10:
Characterization of Laser Diode.

OBJECTIVE: To study characteristics between the Optical power (P0) of a Laser Diode versus Laser Diode Forward current (I_f).

PREREQUISITES:
Basic knowledge of optical communication.

DESCRIPTION:
a. Introduction to experiment -30 min
b. Connection of experiment and its verifications
c. Experimental determination of VSWR meter.
d. Mathematical calculations to find VSWR

EXPERIMENT NO 11:
Intensity modulation of Laser output through an optical fiber.
OBJECTIVE: To Study the Intensity modulation of Laser diode output through an optical fiber

PREREQUISITES:
Basic knowledge of optical communication.

DESCRIPTION:
a. Introduction to experiment -30 min
b. Connection of experiment and its verifications
c. Experimental determination.

EXPERIMENT NO 12:
Measurement of Data rate for digital optical link.

OBJECTIVE: To Connect RS232 port of two computers using optical fiber digital link, transmit data from one computerover this link and receive same data on other computer.

PREREQUISITES:
Basic knowledge of optical communication.

DESCRIPTION:
a. Introduction to experiment -30 min
b. Connection of experiment and its verifications
c. Experimental Verification.

EXPERIMENT NO 13:
Measurement of Numerical Aperture of fiber cable.

OBJECTIVE: The aim of the experiment is to determine the Numerical Aperture of the given Optical Fiber (either glass fiber or plastic fiber).

PREREQUISITES:
Basic knowledge of optical communication.

DESCRIPTION:
a. Introduction to experiment -30 min
b. Connection of experiment and its verifications
c. Experimental determination of Numerical Aperture.
d. Mathematical calculations to find NA

EXPERIMENT NO 14:
Measurement of losses for Optical link
OBJECTIVE: The aim of the experiment is to study the various types of losses that occur in optical fibers and measure the loss in dB of optical patch cords individually and also connected in tandem using an in-line adaptor.

PREREQUISITES:
Basic knowledge of optical communication.

DESCRIPTION:
a. Introduction to experiment -30 min
b. Connection of experiment and its verifications
c. Experimental determination Bending and Coupling losses of an optical cable.
d. Mathematical calculations of bending and coupling losses of optical cable.

5. LEAD EXPERIMENT

MEASUREMENT OF GAIN OF A WAVE GUIDE HORN ANTENNA

AIM:

To obtain directional pattern of a Horn Antenna.

APPARATUS:

S.NO	*APPARATUS*	*QUANTITY*
1.	Klystron Power Supply	1
2.	Klystron with mount	1
3.	Isolator	1
4.	Fixed Attenuator Detector	1
5.	Frequency meter	1
6.	Parabolic Reflector	1
7.	CRO	1

THEORY:

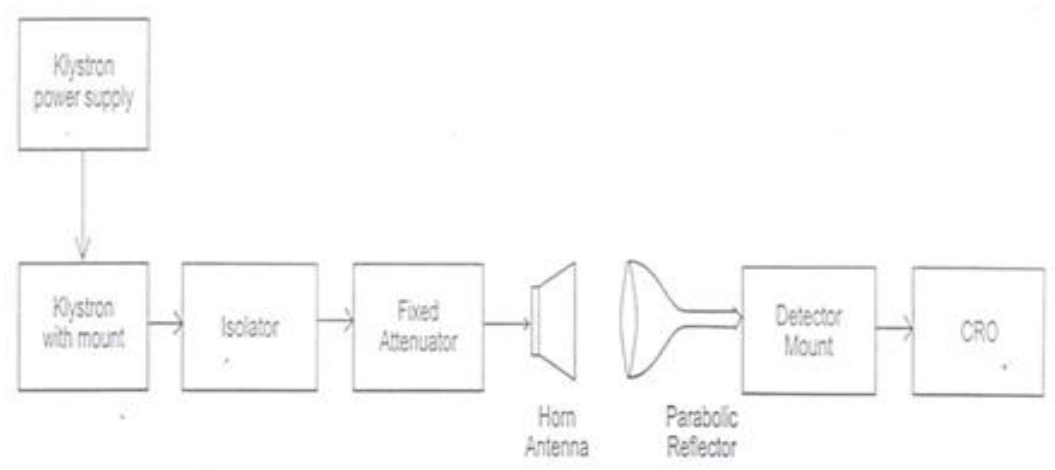
A horn antenna may be regarded as a flared out or opened out wave guide. A wave guide is capable of radiating radiation into open space provided the same is excited at one end and opened at the other end. However, the radiation is much greater through wave guide than the 2 wire transmission line. To overcome reflection and diffraction in the wave guide, the mouth of the waveguide is opened out which assumes the shape of a electromagnetic horn. If the wave guide is terminated by any type of horn, the abrupt discontinuity existed is replaced by a gradual transformation, then all the energy incident in forward direction in the waveguide will now be radiated, provided the impedance matching is proper. This improves directivity and reduces diffraction.

If flaring is done only in one direction, then sectorial horn is produced. If flaring is done along both the walls, then pyramidal horn is obtained. By flaring the walls of the circular waveguide, a concial horn is formed. The fields inside the waveguide propagate in the same manner as in free space, but on reaching

The mouth of the waveguide, these propagating fields continue to propagate in the same general direction but also starts spreading laterally and the wave front eventually becomes spherical. However this may be treated as transition region where the change over from the guided propagation to free space propagation occurs. Since the waveguide impedance & free space impedance are not equal, hence to avoid standing wave ratio, flaring of walls of waveguide is done which besides matching of impedance also provide concentrated radiation pattern(ie)greater directivity and narrower beam width. It is the flared structure that is given the name electromagnetic horn radiator.

The function is to produce a uniform phase front with a larger aperture in comparison to waveguide and thus directivity is greater. If flare angle is very large, the wave front on the mouth of the horn will be curved rather than plane. This will result in non-uniform phase distribution over the aperture, resulting in increased beam width and reduced directivity, and vice versa occurs if the flare angle is very small. The directivityof the horn antenna is given as $D = 7.5\ A/\lambda^2$ where A area of horn mouth opening. Hornantennas are extensively used at microwave frequencies under the condition that power gainneeded is moderate.

EXPERIMENTAL SETUP:



PROCEDURE:

1. Setup the equipments as shown in fig. Keeping the axis of both antennas in same axis line.
2. Energize the microwave source, and set mode 3 determine input power at transmitting antenna end by connecting detector mount.
3. Connect the transmitting antenna back. Turn the receiving horn to the left in 5°steps up to at least 60° and note the corresponding voltage.
4. Repeat the above step but this time turning the receiver to the right and note down the readings.
5. Draw a relative power pattern ie, o/p vs angle.
6. From diagram 3 dB beam width is determined
7. **VIRTUAL LAB EXPERIMENT**

Aim: To find H-plane Tee using HFSS
Description:
HFSS is a commercial finite element method solver for electromagnetic structures. The acronym originally stood for high frequency structural simulator. Not only by experimental set up we can design H plane Tee by using this simulator 3 dimensionally and can see how the power is said to be divided.

(HFSS is the industry-standard simulation tool for 3D full-wave electromagnetic field simulation. HFSS provides E- and H-fields, currents, S-parameters and near and far radiated field results. Intrinsic to the success of HFSS as an engineering design tool is its automated solution process where users are only required to specify geometry, material properties and the desired output. From here HFSS will automatically generate an appropriate, efficient and accurate mesh for solving the problem using the proven finite element method.)

7. SUGGESTED TEXT BOOKS

TEXT BOOKS:

1. Microwave Devices and Circuits – Samul Y. Laio, Pearson , 3rd Edition ,2003
2. Electronics communications Systems-wayne tomasi,pearon,5th Edition.

REFERENCES:

1. Optical fiber communication- Gerd Keiser,TMH,4th Edition ,2008
2. Microwave Engineering-David M. Pozar,John Wiley & Sons (Asia) Pvt Ltd.,1989, 3rd ed.,2011 ,Reprint.
3. Microwave Engineering- G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012.
4. Electronic Communication System- George Kennedy, 6th Ed., McGrawHill.

8. WEBSITES (USEFUL LINKS)

1. www.iitk.ac.in
2. www.iitd.ernet.in
3. https://www.youtube.com/watch?v=TsBTI3tO5-8
4. https://www.youtube.com/watch?v=tXfdv37gTU8
5. https://www.youtube.com/watch?v=WcJnxBsESlM
6. https://www.youtube.com/watch?v=qT6EmMkKevY
7. https://www.youtube.com/watch?v=kp33ZprO0Ck
8. https://www.youtube.com/watch?v=BLa9e2sz5L8
9. https://www.youtube.com/watch?v=g9EUU7dYrok
10. http://www2.electron.frba.utn.edu.ar/~jcecconi/Bibliografia/Ocultos/Libros/ Microwave_Engineering_David_M_Pozar_ 4ed_Wiley_2012.pdf
11. http://www.microwave-eetimes.com/

9. EXPERT DETAILS

INTERNATIONAL:

1. Samuel Y. Liao, professor of electrical Engineering, California University.
2. Philip F.Ordung, professor of electrical Engineering, Yale University.

NATIONAL

10. Manojith Mishra prof. & Head, Deptt. Of Tele communication Engg. B.E College Howrah

11. Prof. S. Bhaskaran - Head, Dept of Electronics, Velammal Engg College Chennai

REGIONAL

1. Prof. N.S. Murthy , Dept. of ECE, NIT, Warangal
2. Mr. T. Subba Rao ,HOD, Dept. of ECE, University college Engineering.

10(A).LAB SCHEDULE:

The lab schedule should be planned once in a week. The week wise scheduled experiment should be completed.

CYCLE 1 (For 30 students per session and 3 students per batch)

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7	week-8
B1, B2	Demo	Exp.1	Exp.2	Exp.10	Exp.9	Exp.7	Exp.8	Lead1
B3, B4	Demo	Exp.2	Exp.10	Exp.9	Exp.8	Exp.1	Exp.3	Lead1
B5, B6	Demo	Exp.10	Exp.9	Exp.8	Exp.1	Exp.2	Exp.7	Lead1
B7, B8	Demo	Exp.9	Exp.8	Exp.1	Exp.3	Exp.10	Exp.2	Lead1
B9, B10	Demo	Exp.8	Exp.1	Exp.2	Exp.7	Exp.3	Exp.10	Lead1

CYCLE 2(For 30 students per session and 3 students per batch)

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**	week-7	week-8
B1, B2	Exp.3	Exp.4	Exp.6	Exp.11	Exp.12	Exp.5	Hobby/lead2	Test
B3, B4	Exp.7	Exp.6	Exp.11	Exp.12	Exp.5	Exp.4	Hobby/lead2	Test
B5, B6	Exp.3	Exp.11	Exp.12	Exp.5	Exp.4	Exp.6	Hobby/lead2	Test
B7, B8	Exp.7	Exp.12	Exp.5	Exp.4	Exp.6	Exp.11	Hobby/lead2	test
B9, B10	Exp.9	Exp.5	Exp.4	Exp.6	Exp.11	Exp.12	Hobby/lead2	test

10(B).VIVA SCHEDULE

ROUND – 1 (For 30 students per session and 3 students per batch)

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
B1,B2,B3	viva						
B4,B5,B6		viva					
B7,B8,B9			viva				
B10,B11,B12				viva			
B13,B14,B15					viva		
B16.B17,B18						viva	
B19,B20							Viva

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
SG1	Viva						
SG2		viva					
SG3			viva				
SG4				Viva			
SG5					viva		
SG6						viva	
SG7							Viva

ROUND – 2

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
B1,B2,B3	viva						
B4,B5,B6		viva					
B7,B8,B9			viva				
B10,B11,B12				viva			
B13,B14,B15					viva		
B16.B17,B18						viva	
B19,B20							Viva

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
SG1	Viva						
SG2		viva					
SG3			viva				
SG4				Viva			
SG5					viva		
SG6						viva	
SG7							Viva

10 (C). SCHEME OF EVALUTION

LAB EXTERNAL

S no.	Write-up (by Internal examiner)	Final evaluation (Internal Examiner)	Result	Viva (External Examiner)
	Aim Equipment needed Circuit diagram Procedure Precautions Tabular form Expected graph	Based on observation, how the student is connecting the circuit, usage of equipment and typical readings And based on correctness of the practical graph to the expected graph and results.	Output of the experiment	Based on understanding of Experiment and theoretical questions in the related subject.
	Marks: 20	**Marks: 30**	**Marks:15**	**Marks: 10**
Total Marks:20+30+15+10=75 Marks				

LAB INTERNAL

Day to Day Evaluation ------ 15 Marks					**Internal Exam ---10M Marks**		
Uniform	Observation & Record	Performance of experiment	Result	Viva Voce	Write-up	Connections & Result	Viva Voce
Marks: 3	**Marks:3**	**Marks:3**	**Marks: 3**	**Marks: 3**	**Marks: 4**	**Marks:4**	**Marks: 2**
Total Marks:15+10=25 Marks							

12. PROJECT/PAPER/PRODUCT BASED LEARNING:

Objective:
To measure the polar pattern and the gain of a waveguide Antennas. (For NV9002)

Equipment Required:
· Microwave source (Gunn or Klystron) with power supply
· Frequency meter
· Isolator
· Variable attenuator
· Detector mount
· Antennas
· SWR meter & accessories.

Theory:
If a transmission line propagating energy is left open at one end, there will be radiation from this end. In case of a rectangular wave-guide this antenna presents a mismatch of about 2:1 and it radiates in many directions. The match will improve if the open waveguide is a horn shape.

The Radiation pattern of an antenna is a diagram of field strength or more often the power intensity as a function of the aspect angle at a constant distance from the radiating antenna. An antenna pattern is of course three dimensional but for practical reasons it is normally presented as a two dimensional pattern in one or several planes. An antenna pattern consists of several lobes, the main lobe, side lobes and the back lobe. The major power is concentrated in the main lobe and it is required to keep the power in the side lobes arid back lobe as low as possible. The power intensity at the maximum of the main lobe compared to the power intensity achieved from an imaginary omni-directional antenna (radiating equally in all directions) with the same power fed to the antenna is defined as gain of the antenna.
3dB Beam Width:This is the angle between the two points on a main lobe where the power intensity ishalf the maximum power intensity.When measuring an antenna pattern,

it is normally most interesting to plot the patternfar from the antenna.Far field pattern is achieved at a minimum distance of

$2D^2/ \lambda 0$ - (for rectangular Horn antenna)

Where D is the size of the broad wall of horn aperture
l0 is free space wave length.
It is also very important to avoid disturbing reflection. Antenna measurement are normally made at outdoor ranges or in so called anechoic chambers made of absorbing materials.
Antenna measurements are mostly made with unknown antenna as receiver. There are several methods to measure the gain of antenna. One method is to compare the unknown antenna with a standard gain antenna with known gain. Another method is to use two identical antennas, as transmitter and other as receiver.
From following formula the gain can be calculated.

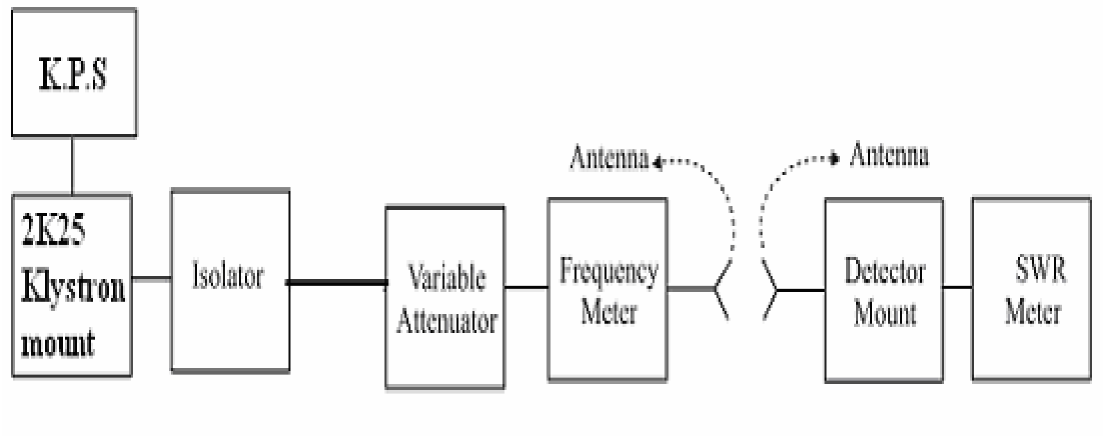
$$P_r=(P_t \lambda_0 G_1 G_2)/(4*pi*s)^2$$

Where
Pt is transmitted power
Pr is received Power,
G1, G2 is gain of transmitting and receiving antenna
S is the radial distance between two antennas
lo is free space wave length.
If both, transmitting and receiving antenna are identical having gain G then above equation becomes.

$$P_r = \frac{P_t \lambda_0 G^2}{(4\pi S)^2}.$$

$$G = \frac{4\pi S}{\sqrt{\lambda_0}} \sqrt{\frac{P_r}{P_t}}$$

In the above equation Pt, Pr and S and lo can be measured and gain can be computed.
As is evident from the above equation, it is not necessary to know the absolute value of Pt and Pr only ratio is required which can be measured by VSWR meter.



Setup for the Antenna Radiation Pattern Plotting

Procedure:

Ø ***Antenna Radiation Pattern Plotting:***

1. Set up the equipments as shown in the figure, keeping the axis of both antennas in same axis line and for start connect horn antenna at both the ends.

2. Energize the Microwave source for maximum output at desired frequency with square wave modulation as per procedure described in experiment 1.

3. Obtain full scale deflection (0 dB) at any convenient range switch position of the SWR Meter by gain control knob of SWR meter or by variable attenuator.

Result and analysis:

4. Turn the receiving horn to the left in 2° or 5° steps up to and note the dB reading. When necessary change the range switches to next higher.

5. Draw the radiation pattern (power vs. angle).

6. Now you can replace the antenna by another given antenna at the receiver position.

7. From diagram determine 3dB width (beam width) of horn antenna.

Ø ***Gain Measurement:***

1. Set up the equipments as shown in fig. Both horns should be in line. Connect standard gain horn antenna (16dB) at transmitter end and any other antenna for which gain is to be measured at the receiver end.

2. Keep the range dB switch of VSWR meter at appropriate position.

3. Energize the Gunn Oscillator for maximum output at desired frequency with modulating amplitude and frequency of potentiometer and by tuning of detector

4. Obtain maximum reading in SWR meter with variable attenuator. Record this reading as Pr (received power).

5. Replace the transmitting horn by detector mount and change the appropriate range db position to get the reading (do not touch the gain control knob) Note and record the range db position and reading as Pt.

6. Now change the horn antenna at the receiver end.

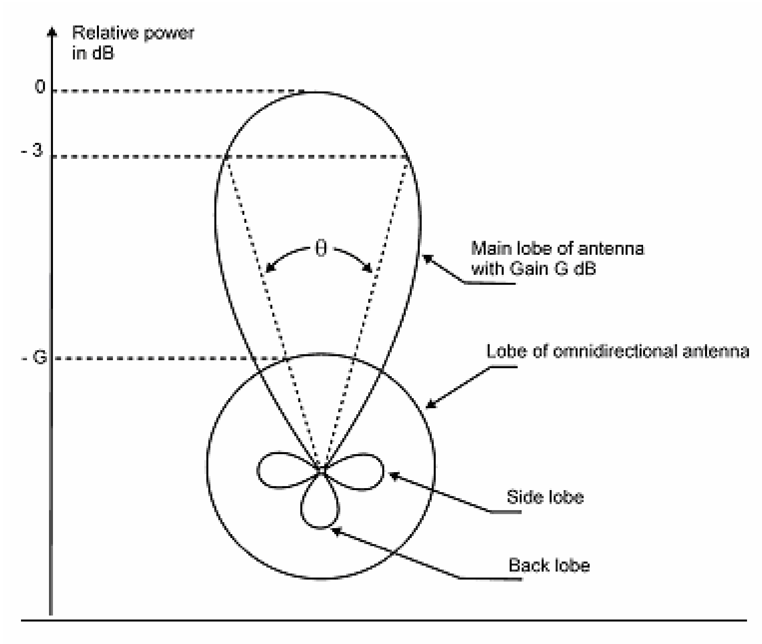
Result and Analysis:

$Pr = (Pt\ \lambda 0\ G1\ G2)/(4\Pi S)^{2}$

Where, Pt = transmitter power

Pr = received power

G1 = Gain of standard horn antenna = 16 dB
G2 = Gain of unknown two antennas
S = Radial distance between two antennas
$\lambda 0$ = Free space wavelength



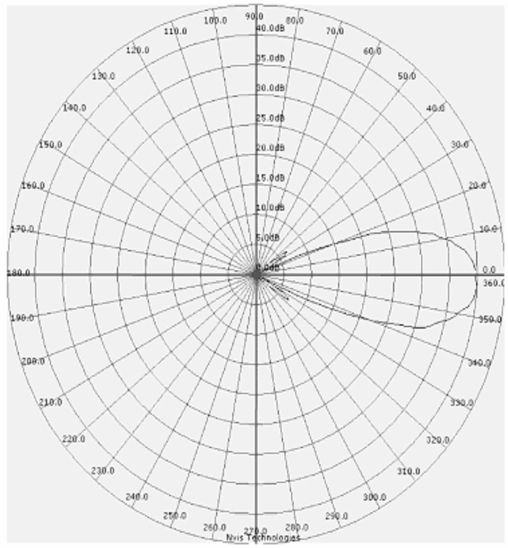
Antenna Pattern Diagram

Procedure for NV9002A

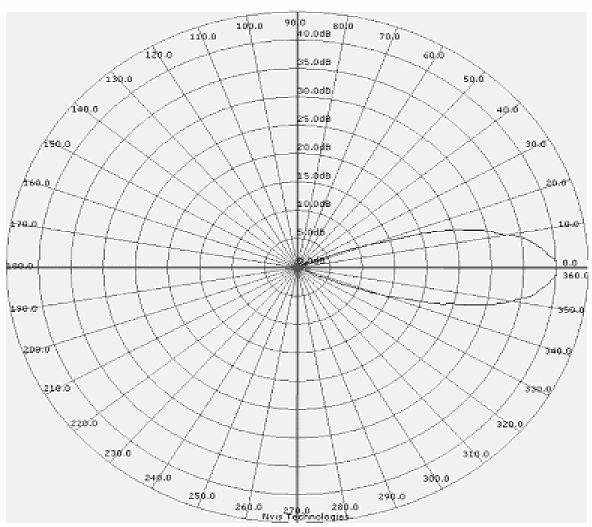
- To take radiation pattern with the help of motorized unit.

1. Arrange the setup as given in pervious (manual procedure)
2. Connect PC interfacing cable between motorized unit and PC COM port.
3. To observe the output, connect the output BNC of unit to CRO.
4. Energize the microwave source for maximum output desired frequency with modulating amplitude & frequency potentiometer and by tuning of detector.
5. Adjust the square wave gain between .5 to 1V at output BNC unit with the help of AM amplitude, Beam voltage and repeller voltage or by adjusting the distance.
6. Install the software by running setup file.
7. Open the S/W window and click ‘config & reset’.
8. Motor will move & come back to its home position. After reaching at home position click the plot button.
9. The plots of different types of antennas are shown but they depend on surrounding conditions & parameters adjusted.
10. Radiation pattern will display on screen. Now other parameters can be measured by using measurement buttons.

Here the polar plots of different types of antennas are given below, but these can vary depends on, surrounding conditions and parameters adjusted.



Dielectric Antenna



E-Plane Sectorial Horn Antenna

12. MAPPING OF LAB WITH PROJECT/ CONSULTANCY/ R&D:

PROPOSALS 2: (An article/white paper from a magazine /journal)

Title: Characterizing the S-Parameters of 75Ω Circuits using 50Ω Lab Equipment

Abstract:

RF engineers working with cable, terrestrial, or satellite TV applications are frequently required to make S-parameter measurements. Using a minimum loss pad to

transform the conventional 50Ω test port impedance to the 75Ω device provides a cheap, easy way to get reasonable measurements. For most general lab applications below 1GHz, a PCB-mounted minimum loss pad built from 1% 0402 similar resistors offers a quick and easy means to test a 75Ω circuit with 50Ω lab equipment. In most cases, the only correction factor required is the insertion loss of the MLP – 5.7dB plus any addition

FUNDED/UNFUNDED PROPOSALS (if any)

TITLE: Seminar on Advancement of microwave communication applications oriented approach.

OBJECTIVE:

This seminar program is intended to bring down the awareness among all Students and staff in order to study the various applications of communication systems like satellite communication, RADAR and Television.

13. GUIDELINES FOR SHADOW ENGINEERING (VIP) AND INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM)

INDUSTRIAL VISITS

S. No	Type of industry	Nature of industry	Date of visit	No. of students participated	Year/branch	Remarks
1	Medha Servo Drives	PCBs			IV/ECE	
2	Doordarshan kendra	Telecast ing			IV/ECE	

TABLE 2: INDUSTRIAL TRAINING (SHADOW ENGINEERING)

S. No	Name of the Course	Nature of industry	Duration of Training	Authority	Date of Training/Certificate No.	remarks
1	OFC	Advanced Training Institute for Electronics and Process Instrumentation	1 Week	GM		

14. ACTIVITIES IN LIFT PROGRAM

CALIBRATION

S.no	Type of equipment	Certificate issued by	Date of calibration	Date of calibration due	Remarks
1	Microwave bench	NVIS Technologies			
2	Microwave bench	NVIS Technologies			

15. MAINTAINANCE AND TROUBLESHOOTING

Maintenance Schedules

S. No.	Name of the Equipment	Date of Maintenance	Type of Activity	Remarks
1	MICROWAVE BENCH SETUP		CHECKING WEATHER PROPERLY CONNECTED OR NOT	

Troubleshooting

S. No	Date of recording activity	Equipment Name	Type of Trouble	Remedial Activity	Remarks
1		MICROWAVE BENCH SETUP	Distortion	PROPERLY CONNECTED BY TIGHTLY CONNECTING ALL COMPONENTS WITH THE HELP OF SCREWS	

16. ASSESSMENT AND ACCREDITATION PROCESDURE AS PER NABL

Accreditation is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to carry out the tasks. It provides the feedback to laboratories as to whether they are performing according to technical competence as per guidelines of NABL (National Accreditation Board for Testing and Calibration Laboratories)

The laboratory should carry out the following important tasks towards getting ready for accreditation from NABL.

1. Preparation of methodology in each experiment
2. Preparation of Standard Operating procedure for each equipment
3. Preparation of Laboratory Manual as per the guidelines specified by Combined Lab Team(CLT) headed by Principal/HOD/Dean/incharge
4. Ensure Effective environmental conditions(temperature, humidity,storage and placement) in the laboratories by implementing proper housekeeping and cleaning of the equipments from dust, dirt etc.
5. Ensure Calibration of instruments/equipment(Only NABL accredited authorized laboratories provide calibration.
6. All the details of Calibration should be included in the format specified exclusively for calibration procedure.
7. Ensure proper implementation of all the documents, formats to be included in the lab manual.
8. Impart training for all the technicians working in labs about the importance of documentation, log sheets, operating procedure of the lab.
9. Incorporate Internal Lab audits for effective functioning of the laboratories. Audits may be once in a month or 3 months or at the end of the semester. The audit schedule will be decided by the Chairman and Principal of the CLT team.
10. Auditors should submit the detailed report of each lab duly signed to the Principal.

11. Each lab should maintain all the bills/invoices of each instrument or equipment in a separate file.
12. All the stock registers either consumable or non consumable should be updated whenever any purchases of consumables or equipment takes place.
13. All the safety precautions are properly displayed in front of each lab.
14. All the Lead experiments should be maintained separately in a record /record in a separate folder.
15. Based on Pre Assessment report submitted by auditor, corrective actions should be carried out by each lab in charge and that must be forwarded to concerned HOD and Principal.