SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, Tirupati

Department of Electronics and Communication Engineering

Supporting Document for 1.1.3

Courses having focus on

Employability/ Entrepreneurship/ skill Development

Program:
M.Tech.- Digital Electronics and Communication Systems

Regulations : SVEC-16

The Courses (with course outcomes) under SVEC-16 Regulations which focus on ***employability/ entrepreneurship/ skill development*** are highlighted with the following colours.

Skill

Employability

Entrepreneurship

ACADEMIC REGULATIONS

COURSE STRUCTURE

AND

DETAILED SYLLABI

For

MASTER OF TECHNOLOGY

In

Digital Electronics and Communication Systems (DECS)

(For the batches admitted from 2016-2017)

CHOICE BASED CREDIT SYSTEM

SREE VIDYANIKETHAN ENGINEERING COLLEGE

(AUTONOMOUS)

(Affiliated to JNTU Anantapur, Approved by AICTE
Programs Accredited by NBA; NAAC with 'A' grade)
Sree Sainath Nagar, A.Rangampet, Near Tirupati - 517 102.A.P.

VISION

To be one of the Nation's premier Engineering Colleges by achieving the highest order of excellence in Teaching and Research.

MISSION

- To foster intellectual curiosity, pursuit and dissemination of knowledge.
- To explore students' potential through academic freedom and integrity.
- To promote technical mastery and nurture skilled professionals to face competition in ever increasing complex world.

QUALITY POLICY

Sree Vidyanikethan Engineering College strives to establish a system of Quality Assurance to continuously address, monitor and evaluate the quality of education offered to students, thus promoting effective teaching processes for the benefit of students and making the College a Centre of Excellence for Engineering and Technological studies.

Department of Electronics and Communication Engineering

Vision

To be a center of excellence in Electronics and Communication Engineering through teaching and research producing high quality engineering professionals with values and ethics to meet local and global demands.

Mission

- The Department of Electronics and Communication Engineering is established with the cause of creating competent professionals to work in multicultural and multidisciplinary environments.

- Imparting knowledge through contemporary curriculum and striving for development of students with diverse background.

- Inspiring students and faculty members for innovative research through constant interaction with research organizations and industry to meet societal needs.

- Developing skills for enhancing employability of students through comprehensive training process.

- Imbibing ethics and values in students for effective engineering practice.

M. Tech. (Digital Electronics and Communication Systems)

Program Educational Objectives

After few years of graduation, the graduates of M. Tech. (DECS) Program would have

PEO1. Enrolled or completed research studies in the core or allied areas of Digital Electronics and Communication Systems.

PEO2. Successful entrepreneurial or technical career in the core or allied areas of Digital Electronics and Communication Systems.

PEO3. Continued to learn and to adapt to the world of constantly evolving technologies in the core or allied areas of digital electronics and communication systems.

Program Outcomes

On successful completion of the Program, the graduates of M. Tech. (DECS) Program will be able to

PO1. Demonstrate in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.

PO2. Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

PO3. Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO4. Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.

PO5. Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

PO6. Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve

common goals and further the learning of themselves as well as others.

PO7. Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.

PO8. Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO9: Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10. Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO11. Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

Programme Specific Outcomes

On successful completion of the Program, the graduates of M.Tech. (DECS) Program will be able to

PSO1. Demonstrate in-depth knowledge of digital electronics, signal processing and communication systems with global perspective and an ability to process and integrate the existing and new knowledge for enhancement of knowledge.

PSO2. Analyze complex engineering problems critically and synthesize information to make intellectual and creative advances in the domains of digital electronics, signal processing and communication systems.

PSO3. Design and Develop solutions for real world problems in the domains of digital electronics, signal processing and communication systems.

PSO4. Provide a wide range of feasible and optimal solutions for complex engineering problems in the domains of digital electronics, signal processing and communication systems.

PSO5. Make research contributions individually or in groups to the development of scientific/ technological knowledge in the domains of digital electronics, signal processing and communication systems.

PSO6. Apply appropriate techniques, resources, and modern tools to complex engineering activities in the domains of digital electronics, signal processing and communication systems.

The Challenge of Change

*"**M**astery of change is in fact the challenge of moving human attention from an old state to a new state. Leaders can shift attention at the right time and to the right place. The real crisis of our times is the crisis of attention. Those who lead are the ones who can hold your attention and move it in a purposeful way. Transformation is nothing but a shift in attention from one form to another. The form of a beautiful butterfly breaks free from a crawling caterpillar. If you pay enough attention, you would be able to see how the butterfly hides within the caterpillar. The leader points out a butterfly when the follower sees only a caterpillar".*

- Debashis Chatterjee

ACADEMIC REGULATIONS
CHOICE BASED CREDIT SYSTEM
M. Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2016–17)

For pursuing Two year degree program of study in Master of Technology (M.Tech) offered by Sree Vidyanikethan Engineering College under Autonomous status and herein after referred to as SVEC (Autonomous):

1. Applicability : All the rules specified herein, approved by the Academic Council, shall be in force and applicable to students admitted from the academic year 2016-2017 onwards. Any reference to "College" in these rules and regulations stands for SVEC (Autonomous).

2. Extent: All the rules and regulations, specified hereinafter shall be read as a whole for the purpose of interpretation and as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. It shall be ratified by Academic Council in the forth coming meeting. As per the requirements of statutory bodies, Principal, SVEC (Autonomous) shall be the Chairman, Academic Council.

3. Admission :

3.1. Admission into the Two Year M. Tech. Degree Program of study in Engineering:

3.1.1. Eligibility:

- A candidate seeking admission into the two year M. Tech Degree Program should have

  (i) Passed B.Tech / B.E or equivalent Program recognized by JNTUA, Anantapuramu, for admission as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

  (ii) A minimum percentage of marks in the qualifying degree as prescribed by the AICTE / UGC or Government at the time of admission.

  (iii) Rank / score secured in the PGECET / GATE examination conducted by APSCHE/ MHRD for allotment of a seat by the convener PGECET, for admission.

3.1.2. Admission Procedure:

Admissions are made into the two year M.Tech. Degree Program as per the stipulations of APSCHE, Government of Andhra Pradesh:

(a) By the Convener, PGECET (for Category–A Seats)

(b) By the Management (for Category-B Seats).

4. Programs of study offered leading to the award of M.Tech. Degree and Eligibility:

Following are the two year postgraduate degree Programs of study offered in various branches at in SVEC (Autonomous) leading to the award of M.Tech. degree and eligibility to get admission into the Programs:

Name of the specialization	Offered by the Department	Name of the Degree / Branch eligible for Admission
Electrical Power Systems	EEE	BE/ B.Tech / AMIE in Electrical & Electronics Engineering / Electrical Engineering or equivalent
Digital Electronics and Communication Systems	ECE	BE / B.Tech in ECE / AMIE in ECE, AMIE (Electronics & Telecommunication Engineering) / AMIETE (Electronics & Telematics Engineering)/ Electronics & Computer Engineering/ Electronics/ Electronics & Telematics or equivalent
Communication Systems		
VLSI		BE / B.Tech / AMIE in ECE, / EEE / CSE / Electronics & Computer Engineering / ETE / IT / CSIT / Electronics and Control Engineering / Instrumentation Engineering / Instrumentation Technology / EIE / Electronics Engineering / Bio-Medical Engineering / AMIETE (Electronics & Telematics Engineering)/ Electronics or equivalent
Computer Science	CSE	BE / B.Tech / AMIE in CSE / CSIT / IT / CSSE , M. Sc. (Computer Science), M. Sc. (Information Systems), M. Sc. (Information Technology), MCA or equivalent.
Computer Networks and Information Security		
Software Engineering	IT	

5. Duration of the Program:

5.1 Minimum Duration: The program will extend over a period of two years leading to the Degree of Master of Technology (M.Tech) of the JNTUA, Ananthapuramu. The two academic years will be divided into four semesters with two semesters per year. In first year, each semester shall normally consist of 22 weeks (≥90 working days) having – 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. In second year, each semester shall consists of 18 weeks and the entire year is for project work. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as suggested by UGC, and Curriculum/ Course Structure as suggested by AICTE are followed.

5.2 Maximum Duration: The student shall complete all the passing requirements of the M.Tech degree program within a maximum duration of 4 years including Gap year, this duration reckoned from the commencement of the semester to which the student was first admitted to the program.

I SEMESTER (22 weeks)	**INSTRUCTION PERIOD**:	I Spell : 7 Weeks II Spell : 9 Weeks	16 Weeks
	Internal Examinations :	I Mid : 1 week II Mid : 1 week	2 Weeks
	Preparation & Practical Examinations		2 Week
	External Examinations		2 Weeks
	Semester Break		2 Weeks
II SEMESTER (22 weeks)	**INSTRUCTION PERIOD**:	I Spell : 7 Weeks II Spell : 9 Weeks	16 weeks
	Internal Examinations :	I Mid : 1 week II Mid : 1 week	2 Weeks
	Preparation & Practical Examinations		2 Week
	External Examinations		2 Weeks
	Summer Vacation		4 Weeks
III SEMESTER	Project Work Phase – I		19 Weeks
IV SEMESTER	Project Work Phase – II		19 Weeks
	Project Work Viva-Voce examinations		2 Weeks

6. Course Structure: Each Program of study shall consist of:

- Professional core courses:

  The list of professional core courses are chosen as per the suggestions of the experts, to impart knowledge and skills needed in the concerned specialization of study.

- Professional elective courses:

  Professional elective courses shall be offered to the students to diversify their spectrum of knowledge and skills. The elective courses can be chosen based on the interest of the student to broaden his individual knowledge and skills.

- Audit Courses: Audit courses shall be offered to the students to diversify their knowledge.

Contact periods: Depending on the complexity and volume of the course the number of contact periods per week shall be assigned.

7. Credit System: All Courses are to be registered by a student in a Semester to earn Credits. Credits are assigned based on the following norms given in Table 1.

Table 1

Course	Periods/Week	Credits
Theory	01	01
Practical	04	02
Seminar	--	02
Project Work Phase-I	--	--
Project Work Phase-II	--	28

i. As a norm, for the theory courses, **one credit** for one contact period per week is assigned.

ii. As a norm, for practical courses **two credits** will be assigned for four contact periods per week.

iii. For courses like Project/Seminar, where formal contact periods are not specified, credits are assigned based on the complexity of the work to be carried out.

iv. There are no credits for audit courses.

Other student activities like NCC, NSS, Sports, Study Tour, Guest Lecture etc. will not carry Credits.

The two year curriculum of any M. Tech Degree Program of study shall have total of **86** credits (28 credits in I Semester, 30 credits in II Semester and 28 credits in IV Semester).

8. Choice Based Credit System (CBCS):

Choice Based Credit System (CBCS) is introduced based on UGC guidelines in order to promote:

- Student centered learning
- Cafeteria approach

- Students to learn courses of their choice
- Learning at their own pace
- Interdisciplinary learning

- A student is introduced to "Choice Based Credit System (CBCS)"
- The total credits for the Programme is 86.
- A student has choice of registering for credits from the theory courses offered in the program ensuring the total credits in a semester are between 24 and 34.
- In I Semester, the student has the option of registering for one additional theory course from the latter semester or dropping one existing theory course from the current semester within the course structure of the program. In II Semester also, the student has the option of registering for one additional theory course from the previous semester if dropped earlier within the course structure of the program. However the maximum number of credits the student can register in a particular semester cannot exceed 33 credits.
- Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
- All the registered credits will be considered for the calculation of final CGPA.

9. Course Enrollment and Registration

9.1 Each student, on admission shall be assigned to a Faculty Advisor (Mentor) who shall advice and counsel the student about the details of the academic programme and the choice of courses considering the student's academic background and career objectives.

9.2 The enrollment of courses in I Semester will commence on the day of admission. If the student wishes, the student may drop or add courses (vide clause 8) within **three** days before commencement of I semester class work and complete the registration process. The student shall enroll for the courses with the help of the student's Faculty Advisor (Mentor). The enrollment of courses in II Semester will commence 10 days prior to the last instructional day of the I semester and complete the registration process for all the remaining theory courses as per program course structure, duly authorized by the Chairman, Board of studies of concern department.

9.3 If any student fails to register the courses in a semester, he shall undergo the courses as per the program structure.

9.4 After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Assessment marks and appear for the Semester-end Examinations.

9.5 No elective course shall be offered by a Department unless a minimum of 8 students register for the course.

10. Massive Open Online Course (MOOC)

A Massive Open Online Course (MOOC) is an online course aimed at unlimited participation and open access via the web. MOOC is a model for delivering learning content online to any person who takes a course, with no limit on attendance.

- A student shall undergo a "Massive Open Online Course (MOOC)" for award of the degree besides other requirements.
- A student is offered this Online Course at the beginning of his II Semester of study and the course has to be completed by the end of III Semester. If the student fails to complete the course by the end of III Semester, it shall be treated as a backlog and needs to be completed before completion of the program for the award of the degree.
- The student shall confirm registration by enrolling the course within 10 days prior to the last instructional day of the I semester like other courses.
- The courses will be approved by the Chairman, Academic Council, SVEC based on the recommendations of the Chairman, Board of Studies of concerned program considering current needs.
- A student has a choice of registering for only one MOOC with the recommendation of Chairman, Board of studies of concerned program and duly approved by the Chairman, Academic Council, SVEC.
- The student shall undergo MOOC without disturbing the normal schedule of regular class work.
- One faculty member assigned by the Head of the Department shall be responsible for the periodic monitoring of the course implementation.
- No formal lectures need be delivered by the faculty member assigned to the students.
- If any student wants to change the MOOC course already registered, he will be given choice to register a new MOOC course in M. Tech. II / III Semester only, with the recommendation of Chairman, Board of studies of concerned program and duly approved by the Chairman, Academic Council, SVEC.
- Finally, the performance of the student in the course will be evaluated as stipulated by the course provider. A certificate will be issued on successful completion of the course by the course provider.
- The performance in the MOOC will not be considered for the calculation of SGPA and CGPA of the student.
- The MOOC course will be listed in the grade sheets of the student.

11. Break of Study from a Programme (Gap Year)

11.1 A student is permitted to go on break of study for a maximum period of one year.

11.2 The student shall apply for break of study in advance, in any case, not later than the last date of the first assessment period in a semester. The application downloaded from website and duly filled by the student shall be submitted to the Head of the Department. In the case of start-up for incubation of idea only, the application for break of study shall be forwarded by the Head of the Department to the Principal, SVEC. A sub-committee appointed by the principal shall give recommendations for approval.

11.3 The students permitted to rejoin the programme after break of study shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new regulations shall apply to the Principal, SVEC in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

11.4 The total period for completion of the programme reckoned from the commencement of the I Semester to which the student was admitted shall not exceed the maximum period specified in clause 5.2 irrespective of the period of break of study in order that the student may be eligible for the award of the degree (vide clause 19).

11.5 If a student has not reported to the department after approved period of break of study without any intimation, the student is treated as detained in that semester. Such students are eligible for readmission for the semester when offered next.

12. Examination System: All components in any Program of study shall be evaluated through internal evaluation and / or an external evaluation conducted as semester-end examination.

12.1. Distribution of Marks:

<table>
<tr><th>Sl. No.</th><th>Course</th><th>Marks</th><th>Examination and Evaluation</th><th>Scheme of examination</th></tr>
<tr><td rowspan="3">1.</td><td rowspan="3">Theory</td><td>60</td><td>Semester-end examination of 3 hours duration (External evaluation)</td><td>The examination question paper in theory courses shall be for a maximum of 60 marks. The question paper shall be of descriptive type with 5 questions, taken one from each unit of syllabus, having internal choice and all 5 questions shall be answered. All questions carry equal marks.</td></tr>
<tr><td rowspan="2">40</td><td rowspan="2">Mid-term Examination of 2 hours duration (Internal evaluation).</td><td>The question paper shall be of descriptive type with 5 essay type questions out of which 4 are to be answered and evaluated for 40 marks.</td></tr>
<tr><td>Two mid-term examinations each for 40 marks are to be conducted. For a total of 40 marks, 75% of better one of the two and 25% of the other one are added and finalized.
Mid-I: After first spell of instruction (I to II Units).
Mid-II: After second spell of instruction (III to V Units).</td></tr>
<tr><td>2</td><td>Laboratory</td><td>50</td><td>Semester-end Lab Examination for 3 hours duration (External evaluation)</td><td>50 marks are allotted for laboratory examination during semester-end.</td></tr>
</table>

Sl. No.	Course	Marks	Examination and Evaluation		Scheme of examination
		50	30	Day-to-Day evaluation for Performance in laboratory experiments and Record. (Internal evaluation).	Two laboratory examinations, which includes Day-to-Day evaluation and Practical test, each for 50 marks are to be evaluated. For a total of 50 marks 75% of better one of the two and 25% of the other one are added and finalized. **Laboratory examination-I:** Shall be conducted just before I mid-term examinations. **Laboratory examination-II:** Shall be conducted just before II mid-term examinations.
			20	Practical test (Internal evaluation).	
3	Audit Course	-	-		Audit course will be conducted as given in 12.2.1
4	Seminar	100	Semester-end Examination		100 marks are allotted for Seminar during semester-end evaluation by the Departmental Committee (DC) as given in 12.2.2.
5	Project Work	400	200	External evaluation	Semester-end Project Viva-Voce Examination by Committee as detailed in 12.2.3.
			200	Internal evaluation	Continuous evaluation by the DC as detailed in 12.2.3.

12.2 Audit Course/ Seminar/Project Work Evaluation:

12.2.1. Audit Course: For audit course, attendance shall be maintained like in case of any regular course. Students may be encouraged to submit assignments and give presentations on the course topics. There won't be any examinations for audit courses. However, the courses shall be listed in the grade sheet of the student.

12.2.2. Seminar: For the seminar, the student shall collect information through literature survey on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the Department a week before presentation. The report and the presentation shall be evaluated at the end of the semester during the period of preparation and practicals by the Departmental Committee (DC) consisting of two senior faculty members and concerned supervisor of the department. The DC is constituted by the Principal on the recommendations of the Head of the Department. The department shall have individual DCs for each M. Tech. Program with senior faculty members and the supervisor specialized in the program.

12.2.3. Project Work:

12.2.3.1. Student shall register for the Project work with the approval of DC in the III Semester and continue the work in the IV Semester too. The DC shall monitor the progress of the project work. In III Semester, Phase–I of the Project Work has to be completed. A Student has to identify the topic of work, collect relevant Literature, preliminary data, implementation tools/ methodologies etc., and perform a critical study and analysis of the problem identified. He shall submit status report in two different phases in addition to oral presentation before the DC for evaluation and award of internal marks

at the end of Phase –I. A candidate shall continue the Project Work in IV Semester (Phase – II) and submit a Project report at the end of Phase–II after approval of the DC. During Phase–II, the student shall submit status report in two different phases, in addition to oral presentation before the DC. The DC shall evaluate the project based on the progress, presentations and quality of work. A candidate shall be allowed to submit the dissertation only after passing all the courses from 1st to 3rd semesters and on recommendations of the DC. The Viva-Voce examination shall be conducted as per the IV Semester examinations schedule.

12.2.3.2 Three copies of the dissertation certified in the prescribed form by the concerned Supervisor and HOD shall be submitted to the Department. One copy is to be submitted to the Chief Controller of Examinations, SVEC (Autonomous) and one copy to be sent to the examiner. The examiner shall be nominated by the Chief Controller of the Examinations from the panel of three examiners submitted by the Department for a maximum of 5 students at a time for adjudication.

12.2.3.3 If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the concerned Supervisor, Head of the Department and the examiner who adjudicated the dissertation. The board shall jointly evaluate the candidates project work. If the report of the examiner is not favorable, the candidate should revise and resubmit the project report followed by Viva-Voce examination.

12.2.3.4 The candidates who fail in Viva-Voce examination shall have to re-appear the Viva-Voce examination after three months. Extension of time within the total permissible limit for completing the project is to be obtained from the Chairman, Academic Council, SVEC (Autonomous).

12.2.3.5 If a candidate desires to change the topic of the project already chosen, during Phase–II, he has to re-register for Project work with the approval of the DC and repeat Phases–I & II. Marks already earned in Phase–I stand cancelled.

12.2.3.6 If a candidate unable to complete the project work after Phase–II and desires to change the topic of the project already chosen, he has to re-register for Project work with the approval of the DC and repeat Phases–I & II. Marks already earned in Phase–I & II stand cancelled.

12.3. Eligibility to appear for the semester-end examination:

12.3.1 A student shall be eligible to appear for semester-end examinations if he acquires a minimum of 75% of attendance in aggregate of all the courses in a semester.

12.3.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

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

12.3.4 Students whose shortage of attendance is not condoned in any semester shall not be eligible to take their semester-end examination and their registration shall stand cancelled.

12.3.5 A student shall not be promoted to the next semester unless he satisfies the attendance requirements of the semester, as applicable. The student may seek readmission for the semester when offered next. He will not be allowed to register for the courses of the semester while he is in detention.

12.3.6 A stipulated fee shall be payable to the college towards condonation of shortage of attendance.

12.4. Evaluation: Following procedure governs the evaluation.

12.4.1. Marks for components evaluated internally by the faculty should be submitted to the Controller of Examinations one week before the commencement of the semester-end examinations. The marks for the internal evaluation components shall be added to the external evaluation marks secured in the semester-end examinations, to arrive at total marks for any course in that semester.

12.4.2. Performance in all the courses is tabulated course-wise and shall be scrutinized by the Results Committee and moderation is applied if needed, and course-wise marks are finalized. Total marks obtained in each course are converted into letter grades.

12.4.3. Student-wise tabulation shall be done and individual grade sheet shall be generated and issued.

12.5. Personal verification / Revaluation / Recounting:

Students shall be permitted for personal verification/request for recounting/ revaluation of the semester-end examination answer scripts within a stipulated period after payment of prescribed fee. After recounting or revaluation, records shall be updated with changes if any and the student shall be issued a revised grade sheet. If there are no changes, the student shall be intimated the same through a notice.

12.6. Supplementary Examination:

In addition to the regular semester-end examinations conducted, the College may also schedule and conduct supplementary examinations for all the courses of other semesters when feasible for the benefit of students. Such of the candidates writing supplementary examinations may have to write more than one examination per day.

13. Re-Registration for Improvement of Internal Marks:

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

13.1 The candidate should have completed the course work and obtained examinations results for I and II semesters.

13.2 Out of the courses the candidate has failed in the examinations due to internal evaluation marks secured being less than 50%, the candidate shall be given one chance for a maximum of 3 theory courses for improvement of internal evaluation marks.

13.3 He should have passed all the remaining courses for which the internal evaluation marks secured more than or equal to 50%.

13.4 The candidate has to register for the chosen courses and fulfill the academic requirements.

13.5 For each course, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D./ Challan in favour of the Principal, Sree Vidyanikethan Engineering College payable at Tirupati along with the requisition through the concerned Head of the Department.

13.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the semester-end examinations markssecured in the previous attempt(s) for the re-registered courses stand cancelled.

14. Academic Requirements for completion of M.Tech Program of study:

The following academic requirements have to be satisfied in addition to the attendance requirements for completion of M.Tech Program of study.

14.1 A student shall be deemed to have satisfied the minimum academic requirements for each theory, laboratory and project work, if he secures not less than 40% of marks in the semester-end examination and a minimum of 50% of marks in the sum total of the internal evaluation and semester-end examination taken together. For the seminar, he should secure not less than 50% of marks in the semester-end examination.

14.2 A student shall register for all the 86 credits and earn all the 86 credits. Marks obtained in the 86 credits shall be considered for the calculation of the DIVISION based on CGPA.

14.3 A student who fails to earn 86 credits as indicated in the curriculum within **four** academic years from the year of his admission shall forfeit his seat in M.Tech. Program and his admission stands cancelled.

15. Transitory Regulations:

Students who got detained for want of attendance (**or**) who have not fulfilled academic requirements (**or**) who have failed after having undergone the Program in earlier regulations (**or**) who have discontinued and wish to continue the Program are eligible for admission into the unfinished semester from the date of commencement of class work with the same (**or**) equivalent courses as and when courses are offered and they will be in the academic regulations into which they are presently readmitted.

A regular student has to satisfy all the eligibility requirements within the maximum stipulated period of **four years** for the award of M.Tech Degree.

16. Grades, Grade Point Average and Cumulative Grade Point Average:

16.1. Grade System: After all the components and sub-components of any course (including laboratory courses) are evaluated, the final total marks obtained shall be converted to letter grades on a "**10 point scale**" as described below.

Grades conversion and Grade points allotted

% of Marks obtained	Grade	Description of Grade	Grade Points (GP)
≥ 95	O	Outstanding	10
≥ 85 to < 95	S	Superior	9
≥ 75 to < 85	A	Excellent	8
≥ 65 to < 75	B	Very Good	7
≥ 55 to < 65	C	Good	6
≥ 50 to <55	D	Pass	5
< 50	F	Fail	0
Not Appeared	N	Absent	0

Pass Marks: A student shall be declared to have passed theory course, laboratory course and project work if he secures minimum of 40% marks in Semester-end examination, and a minimum of 50% marks in the sum total of internal evaluation and Semester-end examination taken together. For the seminar, he shall be declared to have passed if he secures minimum of 50% of marks in the semester-end examinations. Otherwise he shall be awarded fail grade - **F** in such a course irrespective of internal marks. **F** is considered as a fail grade indicating that the student has to pass the semester-end examination in that course in future and obtain a grade other than **F** and **N** for passing the course.

16.2. Semester Grade Point Average (SGPA):

Semester Grade Point Average (SGPA) shall be calculated as given below on a "10 point scale" as an index of the student's performance at the end of each semester:

$$\text{SGPA} = \frac{\sum(C\ X\ GP)}{\sum C}$$

where ***C*** denotes the credits assigned to the courses undertaken in that semester and ***GP*** denotes the grade points earned by the student in the respective courses.

Note: *SGPA is calculated only for the candidates who passed all the courses in that semester.*

16.3. Cumulative Grade Point Average (CGPA):

The CGPA for any student is awarded only when he completes the Program i.e., when the student passes in all the courses prescribed in the Program. The CGPA is computed on a 10 point scale as given below:

$$\text{CGPA} = \frac{\sum(C\ X\ GP)}{\sum C}$$

where ***C*** denotes the credits assigned to courses undertaken up to the end of the Program and *GP* denotes the grade points earned by the student in the respective courses.

17. Grade Sheet: A grade sheet (Marks Memorandum) shall be issued to each student indicating his performance in all courses registered in that semester indicating the SGPA.

18. Transcripts: After successful completion of the entire Program of study, a transcript containing performance in all academic years shall be issued as a final record. Duplicate transcripts will also be issued, if required, after payment of requisite fee. Partial transcript will also be issued upto any point of study to a student on request.

19. Award of Degree: The Degree shall be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Ananthapuramu on the recommendations of the Chairman, Academic Council, SVEC (Autonomous).

19.1. Eligibility: A student shall be eligible for the award of M.Tech Degree if he fulfills all the following conditions:

- Registered and successfully completed all the components prescribed in the Program of study to which he is admitted.
- Successfully acquired the minimum required credits as specified in the curriculum corresponding to the Program of study within the stipulated time.
- Obtained CGPA greater than or equal to 5.0 (Minimum requirement for declaring as passed).
- Has no dues to the College, Hostel, Library etc. and to any other amenities provided by the College.
- No disciplinary action is pending against him.

19.2. Award of Division: Declaration of division is based on CGPA.

Awarding of Division

CGPA	Division
> = 7.0	First Class with Distinction
> = 6.0 and < 7.0	First Class
> = 5.0 and < 6.0	Second Class

20. Additional academic regulations:

20.1 A student may appear for any number of supplementary examinations within the stipulated time to fulfill regulatory requirements for award of the degree.

20.2 In case of malpractice/improper conduct during the examinations, guidelines shall be followed as shown in the **Annexure-I**.

20.3 When a student is absent for any examination (Mid-term or Semester-end) he shall be awarded **zero** marks in that component (course) and grading will be done accordingly.

20.4 When a component is cancelled as a penalty, he shall be awarded zero marks in that component.

21. Withholding of Results:

If the candidate has not paid dues to the College/University (or) if any case of indiscipline is pending against him, the result of the candidate shall be withheld and he will not be allowed/promoted to the next higher semester

22. Amendments to regulations:

The Academic Council of SVEC (Autonomous) reserves the right to revise, amend, or change the Regulations, Scheme of Examinations, and / or Syllabi or any other policy relevant to the needs of the society or industrial requirements etc., with the recommendations of the concerned Board(s) of Studies.

23. General:

The words such as "he", "him", "his" and "himself" shall be understood to include all students irrespective of gender connotation.

Note: *Failure to read and understand the regulations is not an excuse.*

Annexure-I

GUIDE LINES FOR DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

Rule No.	Nature of Malpractices/ Improper conduct	Punishment
	If the candidate:	
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 course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including labs and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for four consecutive semesters from class work and all Semester-end examinations, if his involvement is established. Otherwise, The candidate is debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course only.
6.	Refuses to obey the orders of the Chief Controller of Examinations/Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for

	instigates others to walk out, or threatens the Controller of Examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the Controller of Examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	the remaining examinations of the courses of that semester. If the candidate physically assaults the invigilator/Controller of the Examinations, then the candidate is also debarred and forfeits his/her seat. 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat.

Note: Whenever the performance of a student is cancelled in any course(s) due to Malpractice, he has to register for Semester-end Examinations in that course(s) consequently and has to fulfill all the norms required for the award of Degree.

SVEC16
M. Tech. (Digital Electronics and Communication Systems)
Course Structure

I-Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
1.	16MT13801	Computer Networks	4	-	-	4	4	40	60	100
2.	16MT13802	Digital Communication Techniques	4	-	-	4	4	40	60	100
3.	16MT13803	Digital System Design and Testing	4	-	-	4	4	40	60	100
4.	16MT13804	Image & Video Processing	4	-	-	4	4	40	60	100
5.	16MT13805	Modern Digital Signal processing	4	-	-	4	4	40	60	100
6.	**Professional Elective-1**		4	-	-	4	4	40	60	100
	16MT20501	Advanced Computer Architecture								
	16MT12541	Soft Computing Techniques								
	16MT13806	ASIC Design								
	16MT13807	Transform Techniques								
7.	16MT13831	Digital System Design and Testing Lab	-	-	4	4	2	50	50	100
8.	16MT13832	Image & Video Processing Lab	-	-	4	4	2	50	50	100
		Total:	**24**	**-**	**8**	**32**	**28**	**340**	**460**	**800**
9.	16MT13808	Research Methodology (Audit Course)	-	2	-	2	-	-	-	-

II-Semester

S. No.	Course Title	Course Title	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
1.	16MT23801	Detection and Estimation of Signals	4	-	-	4	4	40	60	100
2.	16MT23802	Embedded System Design	4	-	-	4	4	40	60	100
3.	16MT23803	Information Theory and Coding Techniques	4	-	-	4	4	40	60	100
4.	16MT23804	Low Power CMOS VLSI Design	4	-	-	4	4	40	60	100
5.	16MT23805	Wireless Communications	4	-	-	4	4	40	60	100
6.	**Professional Elective-2**		4	-	-	4	4	40	60	100
	16MT23806	Display Technologies and Devices								
	16MT23807	Optical Communications and Networks								
	16MT23808	Real Time Systems								
	16MT23809	Speech Processing								
7.	16MT23831	Communications Lab	-	-	4	4	2	50	50	100
8.	16MT23832	Embedded Systems Lab	-	-	4	4	2	50	50	100
9.	16MT23833	Seminar	-	-	-	-	2	--	100	100
		Total:	**24**	**-**	**8**	**32**	**30**	**340**	**560**	**900**
10.	16MT23810	Intellectual Property Rights (Audit Course)	-	2	-	2	-	-	-	-

III-Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
			L	T	P*	Total		Internal Marks	External Marks	Total Marks
1.	16MT3MOOC	MOOC	-	-	-	-	-	-	-	-
2.	16MT33831	Project Work – Phase I	-	-	-	-	-	100	--	100
Total:			**-**	**-**	**-**	**-**	**-**	**100**	**--**	**100**

*Fulltime Project Work

IV-Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
			L	T	P*	Total		Internal Marks	External Marks	Total Marks
1.	16MT43831	Project Work – Phase II	-	-	-	-	28	100	200	300
Total:			**-**	**-**	**-**	**-**	**28**	**100**	**200**	**300**
Grand Total:							**86**	**880**	**1220**	**2100**

*Fulltime Project Work

M. Tech. - I Semester
(16MT13801) COMPUTER NETWORKS
(Common to DECS & CMS (PE-I))

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --
A Course on Computer Networks and Wireless Communication and Networks at UG Level

COURSE DESCRIPTION:
Advanced computer networks and its architectures; Protocols & Network security; Mobile adhoc networks.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on
   - Architectures and functioning of advanced computer networks like Ethernet, SONET/SDH, Wi-Fi, Frame Relay, ATM networks etc.
   - Protocols like IPv6, MPLS, RSVP, VoIP associated with advanced computer networks.
   - Security features associated with advanced computer networks.
2. Analyze various design issues for conducting research related to the Internet protocol (IP), Wireless LANs and ATM network technologies prominent in high performance scenario.
3. Design and develop techniques for solutions pertaining to the advanced networking technologies.
4. Formulate solutions for engineering problems pertaining to the advanced networking technologies.
5. Initiate research in advanced computer networks.
6. Apply appropriate techniques and tools to complex engineering activities in the field of advanced computer networks.
7. Contribute positively to multidisciplinary scientific research in design and development of Protocols for adhoc network architectures.

DETAILED SYLLABUS

UNIT- I: WIRED AND WIRELESS NETWORKS (10 Periods)
Introduction, Reference models- OSI, TCP/IP; Data Link Control Protocols - HDLC, Point to Point Protocol (PPP); Ethernet- Fast Ethernet, Gigabit Ethernet; Wireless LANS – Merits, topologies, Architecture – Physical Layer, MAC Layer, Frame structure, Applications; Virtual LANs.

UNIT- II: ADVANCED NETWORK ARCHITECTURES (13 Periods)
Circuit switching network - SONET/SDH; Virtual Circuit Networks – Frame Relay, ATM - Protocol Architecture, Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories; Signaling Protocols - MPLS, RSVP; VPN architectures.

UNIT- III: INTERNET TRANSPORT AND APPLICATION PROTOCOLS (11 Periods)
Internet protocol - IPv6, Transport protocols – Connection Oriented protocol TCP, Connectionless protocol UDP; Congestion control in TCP, Domain Name System, Simple Mail Transfer Protocol, WWW and HTTP, Multimedia Applications – RTP, Voice Over IP.

UNIT- IV: SECURITY IN ADVANCED NETWORKS (10 Periods)
Network security, Cryptography - Symmetric Key Cryptography, Public Key Cryptography, Simple Network Management Protocol, Firewalls - Packet filtering, Digital Signature, IP Security.

UNIT- V: MOBILE AD-HOC NETWORKS (11 Periods)

Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks; Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols.

Total Periods: 55

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, New Delhi, 4th edition, 2006
2. Nader F. Mir, Computer and Communication Networks, Pearson Education, 4th edition, 2007.
3. William Stallings, "Data and Computer Communication", Prentice hall, 9th edition, 2010

REFERENCE BOOKS:

1. Jim Kurose, Keith Ross, "Computer Networking: A Top Down Approach", Addison Wesley, 4th edition, July 2007.
2. Andrew S. Tanenbaum "Computer Networks", Pearson Education, 4th edition, 2008.

I M. Tech. – I Semester
(16MT13802) DIGITAL COMMUNICATION TECHNIQUES
(Common to DECS & CMS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --
Course on Digital Communications at UG Level**,** Review of random Variables and Processes

COURSE DESCRIPTION:
Characterization of Communication Signals and Systems; Digital Modulation Techniques; Optimum Receivers for the Additive Gaussian Noise Channel; Spread Spectrum Technique; Multichannel and Multicarrier Systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge in
   - Characterization of communication signals and systems.
   - Digital modulation techniques
   - Communication over AWGN channels
   - Optimum receivers
   - Spread spectrum techniques
   - Multi-carrier communication system
2. Analyze numerical and analytical problems critically for conducting research in the field of Digital Communication Systems.
3. Solve engineering problems and arrive at optimal solutions pertaining to digital communications.
4. Apply appropriate techniques to complex engineering activities in the field of signal processing and communications.

DETAILED SYLLABUS:

UNIT I– CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS (10 periods)
Representation of Band Pass Signals and Systems–Representation of Band Pass Signals, Representation of Linear Band-Pass System, Response of a Band-Pass System to a Band-Pass Signal. Signal Space Representations – Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals. Representation of Digitally Modulated Signals – Memory Less Modulation Methods – PAM Signals, Phase Modulated Signals, QAM Signals, Multidimensional Signals, Orthogonal Multidimensional Signals. Spectral Characteristics of Digitally Modulated Signals – Power Spectra of Linearly Modulated Signals.

UNIT II – DIGITAL MODULATION TECHNIQUES (11 periods)
Digital Modulation – Factors that Influence the Choice of Digital Modulation, Bandwidth and Power Spectral Density of Digital Signals. Linear Modulation Techniques – BPSK, DPSK, QPSK, OQPSK, Π/4 QPSK. Constant Envelope Modulation Techniques – MSK, GMSK, Combined Linear and Constant Envelope Modulation Techniques – M-ary PSK, M-ary QAM.

UNIT III – OPTIMUM RECEIVERS FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL (10 periods)
Optimum Receiver for Signals corrupted by AWGN –Correlation demodulator, Matched Filter Demodulator, Optimum Detector. Performance of the Optimum Receiver for Memory Less Modulation – Probability of Error for Binary Modulation, M-ary Orthogonal Signals, M-ary PAM, M-ary PSK, QAM. Optimum Receiver for Signals with Random Phase

in AWGN Channel – Optimum Receiver for Binary Signals, Optimum Receiver for M-ary Orthogonal Signals.

UNIT IV – SPREAD SPECTRUM TECHNIQUES (13 periods)

Introduction, Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals – Introduction, The Processing Gain and Jamming Margin. Applications of Direct Sequence Spread Spectrum Signals – Anti jamming Application, Low-Detectability Signal Transmission, Code Division Multiple Access. Generation of PN-Sequences, Frequency-Hopped Spread Spectrum Signals, Other Types of Spread Spectrum Signals. Detection of spread spectrum signals- Matched filter receiver, RAKE Receiver.

UNIT V –MULTICHANNEL AND MULTICARRIER SYSTEMS (10periods)

Rayleigh and Rician channels, Multichannel Digital Communications in AWGN Channels; Binary Signals, M-ary Orthogonal Signals. Multicarrier Communications; Single Carrier verses Multicarrier Modulation, Capacity of a Non ideal Linear Filter Channel, OFDM, Modulation & Demodulation in an OFDM, An FFT Algorithm Implementation of an OFDM System. OFDMA.

Total Periods: 54

TEXT BOOKS:

1. John G. Proakis, "Digital Communications", McGraw-Hill, 4th edition, 2001.
2. Theodore S. Rappaport, "Wireless Communications", Pearson Education, 2nd edition, 2002.
3. George R. Cooper & Clare D. McGillem, "Modern Communication and Spread Spectrum", McGraw-Hill Book Company, 1986.

REFERENCE BOOKS:

1. Marvin K. Simon, Jim K Omura, Robert A. Scholtz& Barry K.Levit, "Spread Spectrum Communications", McGraw-Hill, 1st edition,1995.
2. J.Marvin, K.Simon, Sami. M.Hinedi and William C. Lindsey, "Digital Communication Techniques", PHI, 2009.

M. Tech. - I Semester
(16MT13803) DIGITAL SYSTEM DESIGN AND TESTING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Switching Theory and Logic Design at UG Level.

COURSE DESCRIPTION:
Design of digital systems using ROMs, PLAs, CPLDs and FPGAs; Fault diagnosis in combinational and sequential circuits; Fault modeling in programmable logic array.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge in
   - Identifying various Faults in combinational and sequential circuits
   - Test generation algorithms
   - Programmable Logic Devices (PLDs)
   - BIST
2. Analyze complex engineering problems critically for conducting research in the field of digital system design.
3. Design of complex digital systems in combinational and sequential modes.
4. Conceptualize and solve engineering problems to obtain solutions for the design of digital machines.
5. Initiate research in digital system design and testing.
6. Apply appropriate techniques to complex engineering activities in the design of digital systems.
7. Contribute positively to multidisciplinary scientific research in design and development of Fault Diagnosis well suited for wide range of applications.

DETAILED SYLLABUS:

UNIT - I: DESIGN OF DIGITAL SYSTEMS (Periods:11)
ASM charts, Hardware description language and control sequence method, Reduction of state tables, state assignments, Design of Iterative circuits, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs.

UNIT - II: FAULT MODELING & TEST PATTERN GENERATION (Periods:15)
Fault classes and models – Stuck at faults, bridging faults, transition and intermittent faults. Fault diagnosis of Combinational circuits by conventional methods – Path Sensitization technique, Boolean difference method, Kohavi algorithm, D - algorithm, PODEM, Random testing, transition count testing, Signature Analysis and testing for bridging faults.

UNIT - III: FAULT DIAGNOSIS IN SEQUENTIAL CIRCUITS (Periods:11)
Introduction to BIST (Built-In Self Test) concepts, Circuit Test Approach, Transition Check Approach - State identification and fault detection experiment, Machine identification, Design of fault detection experiment.

UNIT - IV: PLA MINIMIZATION AND TESTING (Periods:10)
PLA minimization-PLA folding. Fault model in PLA, Test generation and Testable PLA design.

UNIT - V: ASYNCHRONOUS SEQUENTIAL MACHINES (Periods:08)
Fundamental-mode model, The flow table, Reduction of incompletely specified Machines, races, cycles and hazards.

Total periods:55

TEXT BOOKS:

1. Charles H. Roth, Jr., "Fundamentals of Logic Design ", Cengage Learning, 5th edition, 2004.
2. N. N. Biswas, "Logic Design Theory", PHI, 1993.
3. Miron Abramovici, Melvin Breuer, Arthur Friedman, "Digital Systems Testing and Testable Design", Jaico Publishing House, 2001.

REFRENCE BOOKS:

1. Samuel C. Lee," Digital Circuits and Logic Design, PHI, 1976.
2. Norman Balabanian, Bradley Carlson, "Digital Logic Design Principles", John Wily & Sons, Inc., 2002.
3. Parag K. Lala," Fault Tolerant and Fault Testable Hardware Design", BS Publications, 1990.

M. Tech. - I Semester
(16MT13804) IMAGE & VIDEO PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Digital Communications & Digital Signal Processing at UG Level

COURSE DESCRIPTION:
Image Fundamentals and its transforms; image enhancement techniques; Image compression, Image Restoration & Image Segmentation; Video Processing basics like Representation, Sampling, Motion estimation, Filtering and Compression.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Gain in-depth knowledge in
   - Image Transforms
   - Image Enhancement & Restoration Techniques
   - Image Segmentation & Compression Techniques
   - Video Processing
2. Analyze complex engineering problems critically in the domain of Image Processing for conducting research.
3. Solve engineering problems for feasible and optimal solutions in the core area of Image Processing.
4. Initiate research in image and video processing.
5. Apply appropriate tools and techniques to complex engineering activities in the field of Image Processing.
6. Contribute positively to multidisciplinary scientific research in Image Processing.

DETAILED SYLLABUS

UNIT I: FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS: (10 Periods)
Fundamental steps in Image Processing, Gray scale and color Images, image sampling and quantization, **2-D Transforms:** DFT, Walsh, Hadamard, Haar, KLT, DCT.

UNIT II: IMAGE ENHANCEMENT & RESTORATION: (10 Periods)
Enhancement: Intensity transformation functions, Filters in spatial and frequency domains, histogram processing, homomorphic filtering.
Restoration: Image Degradation Model, Restoration in presence of noise only- spatial filtering, inverse filtering, Wiener filtering and Constrained least squares filtering.

UNIT III: IMAGE COMPRESSION & IMAGE SEGMENTATION: (13 Periods)
Image compression fundamentals -Redundancies, Compression models: Lossy & Lossless, Arithmetic coding, Bit plane coding, Run length coding, symbol based coding, Transform coding, fidelity criteria.
Segmentation: Fundamentals, Point, line and edge detection, Thresholding, Region based segmentation.

UNIT IV: VIDEO PROCESSING - I (11 Periods)
Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling for Analog and Digital Video, Two-Dimensional Rectangular Sampling, Two-Dimensional Periodic Sampling, Sampling on 3-D Structures, Reconstruction from Samples.

UNIT V: VIDEO PROCESSING -II (10 Periods)

Motion Estimation: 2-D Motion vs. Apparent Motion, 2-D Motion Estimation, Methods Using the Optical Flow Equation. Video filtering: motion compensated filtering, noise filtering, restoration, video compression standards.

Total periods: 54

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education, 3rd edition, 2008.
2. A. Murat Tekalp, Digital Video Processing, Prentice-Hall, 1995.

REFERENCE BOOKS:

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education, 2nd edition, 2002.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson Education, Inc., 2002.

M. Tech. - I Semester
(16MT13805) MODERN DIGITAL SIGNAL PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PREREQUISITE: Courses on Digital Signal Processing at UG level.

COURSE DESCRIPTION: Design of digital filter banks; Power spectral estimation; Principles of adaptive filters; Algorithms for error minimization.

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

1. Demonstrate in-depth knowledge in
   - Filter banks and Wavelets
   - Efficient power Spectral Estimation Techniques.
   - Characteristics of adaptive systems
   - Searching algorithms such as gradient and steepest descent
   - Adaptive algorithms like LMS, RLS and Kalman filtering
   - Non-linear adaptive filtering
2. Analyze complex engineering problems critically in digital filter design and the domain of adaptive filtering for conducting research.
3. Design Various Digital Filter Banks for using in Communication Systems.
4. Solve engineering problems for feasible and optimal solutions in the core areas of Multirate signal processing and Adaptive signal processing.
5. Initiate research in modern digital signal processing.
6. Applying Various Techniques related to the Linear Optimum Filters and understand their design considerations
7. Contribute positively to scientific research in signal processing, applications towards society, antennas and spectral analysis.

DETAILED SYLLABUS

UNIT-I: MULTIRATE FILTER BANKS (Periods:12)
Decimation, Interpolation, Sampling rate conversion by a rational factor I/D, Multistage Implementation of sampling rate conversion. Digital Filter Banks: Two-Channel Quadrature-Mirror Filter Bank, Elimination of aliasing, condition for Perfect Reconstruction, Polyphase form of QMF bank, Linear phase FIR QMF bank, IIR QMF bank, Perfect Reconstruction Two-Channel FIR QMF Bank .

UNIT-II: POWER SPECTRAL ESTIMATIONS (Periods:10)
Estimation of spectra from finite duration observation of signals, Non Parametric Methods: Bartlett, Welch, Blackmann & Tukey methods. Performance Characteristics of Nonparametric Power Spectrum Estimators, Parametric Methods: Relation between auto correlation & model parameters, Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.

UNIT III: DEVELOPMENT OF ADAPTIVE FILTER THEORY & SEARCHING THE PERFORMANCE SURFACE (Periods:10)
Introduction to Filtering, Smoothing and Prediction, Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance - Minimum Mean Square Error
Searching the Performance Surface: Methods & Ideas of Gradient Search methods, Gradient Searching Algorithm & its Solution, Stability & Rate of convergence - Learning Curves.

UNIT IV: STEEPEST DESCENT ALGORITHMS, LMS ALGORITHM & APPLICATIONS (Periods:10)

Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

LMS Algorithm: Overview - LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms - LMS Gradient & Stochastic Algorithms, Convergence of LMS algorithm.

Applications: Noise cancellation, Cancellation of Echoes in long distance telephone circuits, Adaptive Beam forming.

UNIT V: RLS ALGORITHM AND KALMAN FILTERING (Periods:14)

RLS Algorithm : Matrix Inversion lemma, Exponentially weighted recursive least square algorithm, update recursion for the sum of weighted error squares, convergence analysis of RLS Algorithm, Application of RLS algorithm on Adaptive Equalization.

Kalman Filtering: Introduction, Recursive Mean Square Estimation Random variables, Statement of Kalman filtering problem, The Innovations Process, estimation of the state using the Innovations Process, Filtering, Initial conditions, Variants of the Kalman Filter.

Total periods: 56

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, Digital signal processing, Principles, Algorithms and applications, Prentice Hall, 4th edition, 2007.
2. Simon Haykin, Adaptive Filter Theory, PE Asia, 4th edition, 2002.

REFERENCE BOOKS:

1. Bernard Widrow, Samuel D. Strearns, Adaptive Signal Processing, PE, 1985.
2. Emmanuel C Ifeacher Barrie. W. Jervis, "DSP - A Practical Approach", Pearson Education, 2nd edition, 2002.

M. Tech. I-Semester
(16MT20501) ADVANCED COMPUTER ARCHITECTURE
(PE-I)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PREREQUISITES: *A course on* "Computer Organization".

COURSE DESCRIPTION
Quantitative design and analysis, memory hierarchy design; parallel computer models and network properties; pipelining, superscalar techniques, multiprocessors and multi computers; Multi-Vector, SIMD and Multi-Core computers

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Acquire knowledge of:
   - Computational models and Computer Architectures.
   - Concepts of parallel computer models.
   - Scalable Architectures.
   - Pipelining, Superscalar processors, multiprocessors, SIMD and Multi core Computers.
2. Analyze architectures of parallel computers, sub systems and their interconnection structures.
3. Apply concepts and techniques of advanced computer architectures to solve engineering problems.
4. Conduct investigations, apply appropriate techniques to analyze and interpret data to gain advanced knowledge and solve new problems.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF QUANTITATIVE DESIGN AND ANALYSIS, MEMORY HIERARCHY DESIGN (Periods:10)
Fundamentals of Quantitative Design and Analysis: Introduction, Classes of computers, Defining Computer Architecture, Trends in technology, Trends in power and energy in ICs, Trends in cost, Dependability, Quantitative Principles of Computer Design.
Memory Hierarchy Design: Introduction, Advanced optimizations of cache performance, Memory technology and optimizations

UNIT-II: PARALLEL COMPUTER MODELS AND NETWORKS PROPERTIES (Periods:10)
Parallel Computer Models: The state of computing, Multiprocessors and multi-computers, Multi vector and SIMD computers,
P**rogram and Networks Properties:** Conditions of Parallelism, Program partitioning and scheduling, Program flow mechanisms, System interconnect architectures.
Examples: Detection of Parallelism in a program using Bernstein's conditions.

UNIT-III: PRINCIPLES OF SCALABLE PERFORMANCE AND MEMORY (Periods:12)
Principles of Scalable Performance: Performance metrics and measures, Parallel Processing applications, Speedup performance laws.
Bus, Cache and Shared memory: Bus systems, Cache memory organizations, Shared memory organizations.

UNIT-IV: PIPELINING, MULTIPROCESSORS AND MULTICOMPUTERS (Periods: 12)
Pipelining: Linear pipeline processors, nonlinear pipeline processors, Instruction pipeline design, Arithmetic pipeline design.

Multiprocessors and Multi-computers: Multiprocessor system interconnects, Cache Coherence and synchronization mechanisms.

UNIT-V: MULTI-VECTOR AND SIMD COMPUTERS, MULTI-CORE COMPUTERS

(Periods: 10)

Multi-Vector and SIMD computers: Vector processing principles, Multi-vector multiprocessors, SIMD computer organizations, The Evolution of Dataflow computers Computer Architecture of Warehouse–Scale Computers

Multi-Core computers: Multi-core organization.

Example Architectures: Intel x86 Multi core Organization

Total Periods: 54

TEXT BOOKS:

1. Kai Hwang and Naresh Jotwani, *"Advanced Computer Architecture,"* McGraw-Hill, New Delhi, 2nd edition, 2011.
2. John L. Hennessy and David A. Patterson, *"Computer Architecture-A Quantitative Approach,"* Elsevier, 5th edition, 2012

REFERENCE BOOKS:

1. William Stallings, *"Computer Organization and Architecture-Designing for performance,"* Pearson Education, 9th edition, 2014.
2. Kai Hwang *"Advanced Computer Architecture,"* Tata McGraw-Hill, New Delhi, 1st edition, 2001.

M. Tech. -I Semester
(16MT12541) SOFT COMPUTING TECHNIQUES
(PE-I)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --

COURSE DESCRIPTION: Artificial neural network; fuzzy logic; Genetic algorithms and Soft Computing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on :
   - Neural networks and fuzzy logic
   - Genetic algorithms
   - Soft Computing techniques
2. Analyze numerical and analytical problems critically to design fuzzy neural networks.
3. Demonstrate problem solving skills in designing efficient Fuzzy Algorithms.
4. Apply appropriate Genetic techniques to solve problems in the field of soft computing

DETAILED SYLLABUS:

UNIT I INTRODUCTION (Periods: 12)
Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: Cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

UNIT II NEURAL NETWORKS (Periods: 12)
McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

UNIT III FUZZY LOGIC (Periods: 10)
Membership functions: Features, fuzzification, methods of membership value assignments Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

UNIT IV GENETIC ALGORITHM (Periods: 10)
Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multi level optimization – real life problem- advances in GA

UNIT V HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS (Periods: 10)
Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach

of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

TEXT BOOKS:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "*Neuro-Fuzzy and Soft Computing*", PHI / Pearson Education, 2004.
2. S.N.Sivanandam and S.N.Deepa, "*Principles of Soft Computing*", Wiley India Pvt Ltd, 2011.

REFERENCE BOOKS:

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, "*Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications*", Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, "*Fuzzy Set Theory: Foundations and Applications*" Prentice Hall, 1997.
3. David E. Goldberg, "*Genetic Algorithm in Search Optimization and Machine Learning*" Pearson Education India, 2013.

M. Tech. I-Semester
(16MT13806) ASIC DESIGN
(PE-I)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on VLSI Design at UG Level.

COURSE DESCRIPTION:
ASIC design categories; Design Libraries; Design Entry; Logic Synthesis; Simulation; Testing; Physical design flow of ASIC.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Gain in-depth knowledge in
   - ASIC Design Styles.
   - ASICs Design Libraries.
   - ASICs Design Issues.
   - ASIC Construction.
2. Analyze problems critically in the field of ASIC Design.
3. Design Application Specific ICs for use in various systems.
4. Solve engineering problems and arrive at optimal solutions in pertaining to ASIC Design.
5. Initiate research in ASIC Design.
6. Apply appropriate techniques, resources and tools to engineering activities to provide appropriate Solution for the development of ASICs.
7. Contribute to multidisciplinary scientific work in the field of ASIC Design.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ASICs (Periods: 10)
Types of ASICs- Full-Custom ASICs, Semicustom ASICs, Standard cell based ASICs, Gate- array based ASICs, Channeled Gate Array, Channel less Gate Array, Structured Gate Array, Programmable Logic Devices, Field-Programmable Gate Arrays, ASIC Design Flow, ASIC Cell Libraries.

UNIT-II: ASIC LIBRARY DESIGN & PROGRAMMABLE ASICs (Periods: 10)
ASIC LIBRARY DESIGN: Transistors as Resistors, Transistor Parasitic Capacitance, Logical Effort, Library cell design, Library Architecture, Gate-Array Design, Standard-Cell Design, Data path-Cell Design.
PROGRAMMABLE ASICs: Anti fuse, Static RAM, EPROM and EEPROM technology, Practical Issues, Specifications.

UNIT-III: LOW-LEVEL DESIGN ENTRY & LOGIC SYNTHESIS (Periods: 12)
LOW-LEVEL DESIGN ENTRY: Schematic Entry, Hierarchical design, The cell library, Names, Schematic Icons & Symbols, Nets, Schematic Entry for ASICs, Connections, Vectored instances and Buses, Edit-in-place, Attributes, Net list Screener, Back-Annotation.
LOGIC SYNTHESIS: A Logic-Synthesis Example**,** Verilog and Logic Synthesis, VHDL and Logic Synthesis, Finite-State Machine Synthesis, Memory Synthesis.

UNIT-IV: SIMULATION, TESTING & ASIC CONSTRUCTION (Periods: 13)
SIMULATION AND TESTING: Types of Simulation -Structural Simulation, Gate-Level Simulation, Static Timing Analysis, Formal Verification, Switch-Level Simulation, Transistor-Level Simulation, Boundary Scan Test, Faults, Fault simulation, Automatic Test-Pattern Generation.

ASIC CONSTRUCTION: Physical Design, System Partitioning, FPGA Partitioning, Partitioning Methods.

UNIT-V: FLOOR PLANNING, PLACEMENT & ROUTING (Periods: 10)
FLOOR PLANNING AND PLACEMENT: Floor planning, Placement, Physical Design Flow, **ROUTING:** Global Routing, Detailed Routing, Special Routing, Circuit Extraction and DRC.

Total Periods: 55

TEXT BOOKS:

1. Micheal John Sebastian Smith, "Application - Specific Integrated Circuits", Addison Wesley Professional, 1997.
2. L. J. Herbst, "Integrated circuit engineering", Oxford University Press, 1996.

REFERENCE BOOKS:

1. Neil H.E. Weste, Kamran Eshraghian, "Principles of CMOS VLSI Design: A Systems Perspective", Addison – Wesley Publication Company, 2nd Edition, 1999.
2. John P. Uyemura, "Introduction to VLSI Circuits and Systems", Wiley, 1st Illustrated Edition, 2002.

M. Tech. - I Semester
(16MT13807)TRANSFORM TECHNIQUES
(Common to DECS & CMS)
(PE-I)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
Course on Signal Processing at UG Level.

COURSE DESCRIPTION:
Continuous Wavelet Transforms; Discrete Wavelet Transforms; Multi Resolution Analysis; Wavelet packets; Applications of Wavelet Transforms.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Gain in-depth knowledge in
   - Multiresolution Analysis
   - Continuous wavelets
   - Discrete wavelets and Filter design.
   - Alternative Wavelets & Wavelet packets
2. Analyze complex engineering problems critically in the area of Signal Processing and communications.
3. Design, conduct experiments, analyze and interpret complex engineering problems and apply appropriate research methodologies for conducting research in Signal Processing.
4. Solve engineering problems with wide range of solutions in the areas of Biomedical Signal Processing, Image Processing, Radar Signal Processing and Communications and arrive at optimum solutions.
5. Initiate research in Transform Techniques.
6. Use appropriate techniques, resources and tools to engineering activities in the fields of Signal Processing and Communications.
7. Contribute to collaborative multidisciplinary scientific work/research by initiating research work on Data compression, Noise reduction, Communications, Image and signal Processing.

DETAILED SYLLABUS

UNIT –I: (14 Periods)
Review of Transforms:
Fourier series and Geometry- Vector space, functions and function spaces. Fourier transform, short-time Fourier transform, Walsh, Hadamard, Haar, Slant, KLT, Hilbert transforms.
Continuous Wavelet Transform:
Introduction, Continuous-Time Wavelets, Definition of the CWT, The CWT as a correlation, Constant Q-Factor Filtering Interpretation and Time-Frequency Resolution, The CWT as an operator, Inverse CWT.

UNIT –II: DISCRETE WAVELET TRANSFORM AND ORTHOGONAL WAVELET DECOMPOSITION (08 Periods)
Introduction, Approximations of vectors in nested linear vector spaces, Example of an MRA-Bases for the Approximation Subspaces and Harr Scaling Function, Bases for the Detail Subspaces and Harr Wavelet, Digital Filter Implementation of the Harr Wavelet Decomposition.

UNIT –III: MRA ORTHONORMAL WAVELETS, AND THEIR RELATIONSHIP TO FILTER BANKS (12 Periods)

Introduction, Formal Definition of an MRA, Construction of a General Orthonormal MRA, A Wavelet basis for MRA, Digital Filtering Interpretation, Examples of Orthogonal Basis Generating Wavelets, Interpreting Orthonormal MRAs for Discrete time signals, Miscellaneous issues Related to PRQMF Filter Banks, Generating Scaling Functions and Wavelets from Filter Coefficients.

UNIT-IV: ALTERNATIVE WAVELET REPRESENTATIONS (09 Periods)

Bi-orthogonal Wavelet Bases, Filtering Relationship for Bi-orthogonal Filters, Examples of Bi-orthogonal Scaling Functions and Wavelets, Two-Dimensional Wavelets, Non-separable Multidimensional Wavelets, Wavelet Packets.

UNIT–V: APPLICATIONS OF WAVELETS (11 Periods)

Wavelet De-noising, Speckle Removal, Edge Detection and Object Isolation, Image Fusion, Object Detection by Wavelet Transforms of Projections, Communication Applications-Scaling Functions as signaling pulses, Discrete Wavelet Multitone Modulation.

Total Periods: 54

TEXT BOOKS:

1. Raghuveer M.Rao and Ajit S.Bopardikar, "*Wavelet Transforms-Introduction theory and applications"*, Pearson Education, 1998.
2. Soman.K.P, Ramachandran.K.I, Resmi.N.G, "*Insight into Wavelets from theory to Practice"*, PHI, 3rd edition, 2010.

REFERENCE BOOKS:

1. R. C. Gonzalez, R. E. Woods, "*Digital Image Processing*," Pearson Education, 2nd edition, 1992.
2. Jaideva C Goswami, Andrew K.Chan, "*Fundamentals of Wavelets-Theory, Algorithms and Applications*", John Wiley and sons, 1999.
3. C.Sidney Burrus, Ramesh A Gopinath and Haitao Guo, "*Introduction to Wavelets and Wavelet Transforms",* Prentice Hall, 1998.

M. Tech. - I Semester
(16MT13831) DIGITAL SYSTEM DESIGN AND TESTING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PRE-REQUISITES:
A Course on Digital Design at UG Level

COURSE DESCRIPTION:
Design and simulation of digital circuits; Implementing digital circuits in FPGAs.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate advanced knowledge in
   - Behavioral system modeling: concurrency and event-driven simulation
   - Digital design modeling using various styles (behavioral, structural and dataflow)
   - Designing Combinational and sequential circuits
   - Verifying the Functionality of Designed circuits using function Simulator
   - Checking for critical path time calculation
   - Placement and routing in FPGA
   - Implement digital designs in FPGA device.
2. Conceptualize and solve problems in logic verification and timing calculation of Digital circuits.
3. Undertake projects efficiently in Digital system design to achieve optimization for high device utilization and performance in industrial needs.
4. Contribute to multidisciplinary groups in design and development of digital systems.
5. Create, develop and use modern CAD tools to analyze problems of RTL schematic, Technology schematic, and system implementation.
6. Communicate effectively in verbal and written forms.

LIST OF EXERCISES

PART- I: (Design and Simulation Experiments)
1. Simulation and Verification of Logic Gates.
2. Design and Simulation of Half adder, Serial Binary Adder, MultiPrecession Adder, Carry Look Ahead Adder and Full Adder.
3. Simulation and Verification of Decoder, MUXs, Encoder using all ModelingStyles.
4. Modeling of Flip-Flops with Synchronous and Asynchronous reset.
5. Design and Simulation of Counters- Ring Counter, Johnson Counter, andUp- Down Counter, Ripple Counter.
6. Design of a N- bit Register of Serial-in Serial-out, Serial in Parallel out,Parallel in Serial out and Parallel in Parallel Out.
7. Design of Sequence Detector (Finite State Machine- Mealy and Moore Machines)
8. 4- Bit Multiplier, Divider. (for 4-Bit Operand)
9. Design ALU to Perform – ADD, SUB, AND-OR, 1's and 2's COMPLIMENT, Multiplication, Division.
10. Design of RAM/ROM

PART-II: (Implementation Steps for Experiments in Part-I)
1. Verification of the Functionality of the circuit using function Simulators.
2. Timing Simulator for Critical Path time Calculation.
3. Synthesis of Digital Circuit.
4. Place and Router Techniques for FPGA's like Xilinx, Altera, Cypress, etc.,
5. Implementation of Design using FPGA and CPLD Devices.

Total Time Slots: 14

REQUIRED SOFTWARE TOOLS:

1. Mentor Graphic tools/Cadence tools/ Synopsys's tools.(220 nm Technology and Above)
2. Xilinx ISE 10.1i and above for FPGA/CPLDS.

REFERENCE BOOKS:

1. John F. Wakerly, "Digital Design: Principles and Practices", Prentice Hall, 3rd edition, 2000.
2. Digital System Design Lab Manual.

M.Tech. – I Semester
(16MT13832) IMAGE & VIDEO PROCESSING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PREREQUISITE:
A course on Image & Video Processing

COURSE DESCRIPTION: Fundamentals of images, image transforms, enhancement, restoration, image compression and coding and video processing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate knowledge in
    - Image Transforms
    - Image Enhancement & Restoration Techniques
    - Image Segmentation & Compression Techniques
    - Video Processing
2. Understand various applications of image processing in industry, Medicine, and defense.
3. Solve engineering problems for feasible and optimal solutions in the core area of Image and video Processing.
4. Initiate research in image and video processing.
5. Acquire an appreciation for the Image and video processing issues and techniques and be able to apply these techniques to real world problems.
6. Contribute positively to multidisciplinary scientific research in Image and video Processing.
7. Communicate effectively in verbal and written forms.

List of Exercises

1. Point processing in spatial domain
    a. Negation of an image
    b. Thresholding of an image
    c. Contrast Stretching of an image
2. Geometric transformations.
    a. Image rotation
    b. Scaling
    c. Translation
3. Logical operations on Digital Image
    a. AND
    b. NAND
    c. OR
    d. NOR
    e. NOT
4. Histogram Equalization and Specification
5. Filtering in spatial domain
    a. smoothing
    b. sharpening
6. Filtering in frequency domain
    a. Low pass filter
    b. High pass filter
7. Edge Detection using derivative filter mask
    a. Prewitt
    b. Sobel
    c. Laplacian

8. Image compression using transform techniques.
9. Zooming and shrinking operations on images
10. Morphological operations on images
11. Representation of Digital video: Read, Write, View Videos and conversion of videos in different formats.
12. Video to frame and frame to Video conversion.

Total Time Slots: 12

Required Software Tools:

1. MATLAB with image processing and computer vision tool box

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 3rd edition, Pearson Education, 2008.
2. A. Murat Tekalp, Digital Video Processing, Prentice-Hall, 1995.

M. Tech. – I Semester
(16MT13808) RESEARCH METHODOLOGY
(Common to all M. Tech. Programs)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	-	2	-	-

PREREQUISITES: --

COURSE DESCRIPTION:

Overview of Research, research problem and design, various research designs, data collection methods, statistical methods for research, importance of research reports and its types.

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

1. Acquire in-depth knowledge on
   - Research design and conducting research
   - Various data collection methods
   - Statistical methods in research
   - Report writing techniques.
2. Analyze various research design issues for conducting research in core or allied areas.
3. Formulate solutions for engineering problems by conducting research effectively in the core or allied areas.
4. Carryout literature survey and apply research methodologies for the development of scientific/technological knowledge in one or more domains of engineering.
5. Select and Apply appropriate techniques and tools to complex engineering activities in their respective fields.
6. Write effective research reports.
7. Develop attitude for lifelong learning to do research.
8. Develop professional code of conduct and ethics of research.

DETAILED SYLLABUS:

Unit-I: Introduction to Research Methodology (Periods: 5)
Objectives and Motivation of Research, Types of Research, Research Approaches, Research Process, Criteria of good Research, Defining and Formulating the Research Problem, Problem Selection, Necessity of Defining the Problem, Techniques involved in Defining a Problem.

Unit-II: Research Problem Design and Data Collection Methods (Periods: 7)
Features of Good Design, Research Design Concepts, Different Research Designs, Different Methods of Data Collection, Data preparation: Processing Operations, Types of Analysis.

Unit-III: Statistics in Research (Periods: 6)
Review of Statistical Techniques - Mean, Median, Mode, Geometric and Harmonic Mean, Standard Deviation, Measure of Asymmetry, ANOVA, Regression analysis.

Unit-IV: Hypothesis Testing **(Periods: 7)**

Normal Distribution, Properties of Normal Distribution, Basic Concepts of Testing of Hypothesis, Hypothesis Testing Procedure, Hypothesis Testing: t-Distribution, Chi-Square Test as a Test of Goodness of Fit.

Unit-V: Interpretation and Report Writing **(Periods: 3)**

Interpretation – Techniques and Precautions, Report Writing – Significance, Stages, Layout, Types of reports, Precautions in Writing Reports.

Total Periods: 28

TEXT BOOK:

1. C.R. Kothari, "*Research Methodology: Methods and Techniques*," New Age International Publishers, New Delhi, 2nd Revised Edition, 2004.

REFERENCE BOOKS:

1. Ranjit Kumar, "*Research Methodology: A step-by-step guide for beginners*," Sage South Asia, 3rd ed., 2011.
2. R. Panneerselvam, "Research Methodology," PHI learning Pvt. Ltd., 2009

M. Tech. -II Semester
(16MT23801) DETECTION AND ESTIMATION OF SIGNALS
(Common to DECS & CMS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Probability and Stochastic Processes at UG Level

COURSE DESCRIPTION:
Decision criteria for single and multiple observations; Estimation techniques; Properties of estimators; parameter Estimation.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate advanced knowledge in
    - Different decision criteria
    - Estimation techniques and their properties
    - Selection of a good estimator for the given specifications.
    - Kalman Filter
    - Statistical estimation of parameters
2. Analyze complex engineering problems critically for conducting research in the field of signal detection and estimation.
3. Design optimum filters for solving problems in the field of Communications.
4. Solve engineering problems to obtain solutions for the design of optimum receivers.
5. Initiate research in detection and estimation of signals.
6. Apply appropriate techniques, resources to complex engineering activities in the field of Communications.
7. Contribute to multidisciplinary scientific work in the field of Communications and Radar Systems.

DETAILED SYLLABUS

UNIT– I: Detection Theory (12 Periods)
Binary Decisions: Single observation**–**Maximum-likelihood decision criterion, Neyman-Pearson criterion, Receiver operating characteristics, Probability-of-error criterion, Bayes risk criterion, Min-max criterion.

UNIT – II: Binary Decisions: Multiple Observations (11 Periods)
Vector observations, the general Gaussian Problem, Waveform Observation in Additive Gaussian Noise, The Integrating Optimum Receiver, Matched Filter Receiver.

UNIT -III: Estimation Theory (12 Periods)
Maximum-likelihood estimation, Bayes estimation criterion - Mean Square Error Criterion, Uniform Cost Function, Absolute-Value Cost Function. Linear minimum-Variance and Least Squares Method, Estimation in the presence of Gaussian noise - Linear observation, Non-linear estimation.

UNIT – IV: Properties of Estimators (**10 Periods)**
Bias, Efficiency, Cramer-Rao bound, Asymptotic properties, Sensitivity and error analysis.

UNIT–V: State Estimation & Statistical Estimation of Parameters (10 periods)
State Estimation: Prediction, Kalman filter, Problem solving.
Statistical Estimation of Parameters: Concept of sufficient statistics, Exponential families of Distributions, Exponential families and Maximum likelihood estimation, uniformly minimum-variance unbiased estimation.

Total periods: 55

TEXT BOOKS:

1. James L.Melsa & David L.Cohn, "Decision and Estimation Theory", McGraw-Hill, 1978.
2. Steven M. Kay, "Statistical Signal Processing Vol. 1: Estimation Theory, Prentice Hall, 1993, Vol. 2: Detection Theory", Prentice Hall Inc., 1998.

REFERENCE BOOKS:

1. Harry L. Van Trees, "Detection, Estimation and Modulation Theory", Part 1, John Wiley & Sons Inc. 1968.
2. Jerry M. Mendel, "Lessons in Estimation Theory for Signal Processing, Communication and Control", Prentice Hall Inc., 1995.
3. Sophocles J.Orfanidis, "Optimum Signal Processing", McGraw-Hill, 2nd edition, 1988.

M. Tech. - II Semester
(16MT23802) EMBEDDED SYSTEM DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
Courses on Digital Logic Design and Programming using 'C' language at UG Level

COURSE DESCRIPTION: Embedded Hardware Challenges and Choice; Real Time Interfacing; Software Architectures; Programming Concepts and Language support; Operating System Concepts; Development Tools; System Design Concepts.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge in
   - Embedded Hardware
   - Software Architectures
   - Embedded Programming Languages
   - Embedded Development Tools
   - Operating System concepts
   - Design Techniques
2. Analyze critically and resolve the issues pertaining to the selection of Hardware, Software architecture, Development tools, operating system and system components from the available lot
3. Solve complex engineering problems in embedded domain with societal impact.
4. Contribute positively in designing and developing solutions with embedded Systems with open mindedness, objectivity and rational approach.
5. Initiate research in Embedded system design.
6. Model embedded systems with chosen set of Hardware, development tools with an understanding of their limitations
7. Apply reasoning and demonstrate skills to take up inter disciplinary research in embedded domain

DETAILED SYLLABUS

UNIT- I:An Introduction to Embedded Systems (10 Periods)
Embedded systems-definition, how are they different, Challenges in Embedded Computing System Design. Processor Embedded into a System, Selection Process, Hardware Units and Devices in a System, Exemplary Embedded Systems, Embedded System-On-Chip (SOC) and use of VLSI Circuit Design Technology, Classification of Embedded Systems

UNIT- II (12 Periods)
Processor Architectures, Memory Organization and Real World Interfacing: Advanced Architectures, Processor and Memory Organization, Performance Metrics, Memory-Types, Maps and Addresses. Processor and Memory Selection
Survey of Software Architectures: Round- Robin, Round- Robin with Interrupts, Function-Queue Scheduling, Real-Time Operating System Architectures, Selecting Architecture.

UNIT- III: Programming Concepts and Embedded Programming in C, C++ and JAVA: (11 Periods)
Software Programming in Assembly language (ALP) and in High-Level language 'C', C Program Elements- Header, Source Files and Pre processor Directives, Macros and Functions, Data Types, Data Structures, Modifiers, Statements, Loops and Pointers. Object-Oriented Programming, Embedded Programming in C++, Java

UNIT- IV: Processes and Operating Systems (11 Periods)
Introduction, Multiple Tasks and Processes, Pre-emptive RTOS, Priority Based Scheduling, Inter process Communication Mechanisms, Evaluating OS Performance, Power Management and Optimization for Processes.

UNIT- V (11 Periods)
Embedded Software Development Tools: Host and Target Machines, Linkers/Locators for Embedded Software, Getting Software into the Target System.
System Design Techniques: Introduction, Design Methodologies, Requirement Analysis, Specifications, System Analysis and Architecture Design.

Total Periods: 55

TEXT BOOKS:

1. Rajkamal, "Embedded systems: Architecture, Programming and Design", TMH, 2nd edition, 2008.
2. Wayne wolf, "Computers as a component: principles of embedded computing system design", Morgan Kaufmann Publishers, 2nd edition, 2008.
3. David E. Simon, "An embedded software primer", Pearson Education, 2008

REFERENCE BOOKS:

1. Arnold S Burger, "Embedded Systems Design: An Introduction to Processes, Tools, and Techniques", Taylor & Francis, 2001.
2. Steve Heath, Butterworth Heinenann, "Embedded systems design: Real world design", Newton mass USA 2002.

M. Tech. - II Semester
(16MT23803) INFORMATION THEORY AND CODING TECHNIQUES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Digital Communications at UG Level

COURSE DESCRIPTION:
Information theory; Channel capacity; Channel coding techniques – Linear block codes, Cyclic codes, Convolutional codes; Reed-Solomon and Turbo codes.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate knowledge in
   - Various aspects of source and channel coding techniques
   - Channel capacity
   - Performance evaluation of various source coding techniques
2. Analyze complex engineering problems critically in the domain of information, source encoding.
3. Design encoder, Syndrome circuits to solve complex engineering problems.
4. Conceptualize and Solve engineering problems for feasible and optimal solutions in the core area of information theory and coding techniques.
5. Initiate research in information theory and coding techniques.
6. Contribute positively to multidisciplinary scientific research in communications with objectivity and rational analysis.

DETAILED SYLLABUS

UNIT I: INTRODUCTION (11 periods)
Entropy: Discrete stationary sources, Markov sources, Entropy of a discrete Random variable- Joint, conditional, relative entropy, Mutual Information and conditional mutual information. Chain rules for entropy, relative entropy and mutual information, Differential Entropy- Joint, relative, conditional differential entropy and Mutual information.
Loss less Source coding: Uniquely decodable codes, Instantaneous codes, Kraft's inequality, optimal codes, Huffman code, Shannon's Source Coding Theorem.

UNIT II: CHANNEL CAPACITY (10 periods)
Capacity computation for some simple channels, Channel Coding Theorem, Fano's inequality and the converse to the Coding Theorem, Equality in the converse to the coding theorem, The joint source Channel Coding Theorem, The Gaussian channels- Capacity calculation for Band limited Gaussian channels, Parallel Gaussian Channels, Capacity of channels with colored Gaussian noise.

UNIT III: CHANNEL CODING-1 (09 periods)
Linear Block Codes: Introduction to Linear block codes, Generator Matrix, Systematic Linear Block codes, , Parity Check Matrix, Syndrome testing, Error correction, Decoder Implementation of Linear Block Codes, Error Detecting and correcting capability of Linear Block codes.

UNIT IV: CHANNEL CODING-2 (13periods)
Cyclic Codes: Algebraic Structure of Cyclic Codes, Binary Cyclic Code Properties, Encoding in Systematic Form, Systematic Encoding with an (n - k)-Stage Shift Register, Error Detection with an (n - k)-Stage Shift Register, Well-Known Block Codes-Hamming Codes, Extended Golay Code, BCH Codes.

Convolutional Codes: Convolution Encoding, Convolutional Encoder Representation, Formulation of the Convolutional Decoding Problem, Properties of Convolutional Codes, Sequential Decoding,

UNIT V: CHANNEL CODING-3 (13periods)

Reed-Solomon Codes- Reed-Solomon Error Probability, Finite Fields, Reed-Solomon Encoding, Reed-Solomon Decoding, Interleaving and Concatenated Codes- Block Interleaving, Convolutional Interleaving, Concatenated Codes. Coding and Interleaving Applied to the Compact Disc Digital Audio System- CIRC Encoding, CIRC Decoding. Turbo Codes-Turbo Code Concepts, Encoding with Recursive Systematic Codes, Feedback Decoder, The MAP Decoding Algorithm.

Total periods:56

TEXT BOOKS:

1. Thomas M. Cover and Joy A. Thomas, Elements of Information Theory, John Wiley & Sons, 1st edition, 1999.
2. Bernard sklar, "Digital Communications – Fundamental and Application", Pearson Education, 2nd edition, 2009.

REFERENCE BOOKS:

1. Robert Gallager, Information Theory and Reliable Communication, John Wiley & Sons, 1st edition, 1968.
2. John G. Proakis, "Digital Communications", Mc. Graw Hill Publication, 5th edition, 2008.
3. Shulin and Daniel. Costello, Jr., "Error Control Coding–Fundamentals and Applications", Prentice Hall, 2nd edition, 2002.

M. Tech.- II Semester
(16MT23804) LOW POWER CMOS VLSI DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on VLSI Design at UG Level.

COURSE DESCRIPTION:
Needs For Low Power VLSI Chips; Principles Of Low Power Design; Simulation and Probabilistic Analysis of Low Power; Logic and Circuit Analysis; Special Techniques Of Low Power Design, Performance Management of an Architecture or a System.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate advanced knowledge in
   - Design of logic Circuits for low power Requirements
   - Power Estimation of Analysis
   - Low power architecture & Systems
   - Low Power Techniques
2. Analyze complex problems critically in the domain of low power CMOS Circuit, effects and issues of devices, for conducting research in VLSI Design.
3. Solve engineering problems with wide range of solutions of low power design challenges, tradeoff between area, speed and power requirements.
4. Apply appropriate research methodologies in Low power CMOS devices of complex engineering activities in the field of VLSI Design.
5. Apply appropriate techniques, Resources and tools in, evaluating electrical properties of low power CMOS devices based on second order effects.
6. Contribute positively to multidisciplinary scientific research work in the design and development of Ultra Low power Integrated Circuits suited for wide range of applications.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO LOW POWER VLSI DESIGN (Periods: 10)

Needs For Low Power VLSI Chips, Charging And Discharging Capacitances Short Circuit Current In CMOS, CMOS Leakage Current, Static Current, Basic Principles Of Low Power Design, Low Power Figure Of Merits.

UNIT-II: (Periods: 10)
Simulation Power Analysis:
Spice Circuit Simulation, Discrete Transistor Modeling And Analysis, Gate Level Logic Simulation, Architecture Level Analysis, Data Correlation Analysis, Monto Carlo Simulation.
Probabilistic Power Analysis:
Random Logic Signals, Probability and frequency, Probabilistic Power Analysis Techniques, Signal Entropy.

UNIT-III: (Periods: 15)
Circuit Analysis:
Transistor and Gate Sizing, Equivalent Pin Ordering, Network Restructuring and Reorganization, Special latches and Flip flops, Low Power Digital Cell Library, Adjustable Device threshold Voltage.
Logic Analysis:
Gate Reorganization, Signal Gating, Logic Encoding, State Machine Encoding, Pre computation Logic.

UNIT-IV: SPECIAL TECHNIQUES **(Periods: 10)**

Power Reduction in Clock Networks, CMOS Floating Node, Low Power Bus, Delay Balancing, Low Power Techniques for SRAM.

UNIT-V: ARCHITECTURE AND SYSTEM **(Periods: 10)**

Power And Performance Management, Switching Activity Reduction, Parallel Architecture with Voltage Reduction, Flow Graph Transformation.

Total Periods: 55

TEXT BOOK:

1. Gary Yeap, "Practical Low-Power Digital VLSI Design," Springer Publication, 1998.

REFERENCE BOOK:

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley Student Edition, 2000.

M. Tech.-II Semester
(16MT23805) WIRELESS COMMUNICATIONS
(Common to DECS & CMS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PREREQUISITES: A Course on Digital Communications at UG Level.

COURSE DESCRIPTION:
Introduction to cellular wireless communication; Radio propagation in mobile atmosphere; Equalization along with Diversity techniques; several access techniques; Introduction to wireless networking; Multicarrier modulation techniques.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate advanced knowledge in
   - Cellular systems and wireless standards
   - Radio wave propagation in wireless environment
   - Equalization and diversity techniques
   - Multiple access techniques and networking
   - Multicarrier modulation
2. Analyze complex engineering problems critically for conducting research in wireless systems.
3. Design a Digital Communication System/ Subsystem for societal needs.
4. Solve engineering problems with wide range of solutions in wireless communications.
5. Apply appropriate techniques to engineering activities in the field of wireless communications.

DETAILED SYLLABUS

UNIT-I: INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS AND CELLULAR CONCEPT (Periods:11)
Evolution of Mobile Radio Communication Systems, Examples of Wireless Communication Systems, 1G, 2G, 2.5G,3G and 4G Wireless Cellular Networks and Standards, Frequency Reuse Concept, Channel Assignment Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems-cell splitting and sectoring. Problem solving.

UNIT – II: MOBILE RADIO PROPAGATION (Periods:11)
Large Scale Path Loss: Introduction, Free Space Propagation Model, Relating Power to Electric field, Propagation Mechanisms – Reflection, Diffraction, and Scattering. Practical Budget Design using Path Loss Models, Outdoor and Indoor Propagation Models. Problem solving.
Small Scale Fading and Multipath: Small Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small Scale Multipath Measurements, Parameters of Mobile Channels, Types of Small Scale Fading (all variations) Statistical Models– Clarke's Model for Flat Fading, and Jake's Model. Problem solving.

UNIT -III: EQUALIZATION & DIVERSITY TECHNIQUES (Periods:11)
Equalization: Introduction, Survey of Equalization Techniques, Linear and Non-linear Equalizers – Linear Transversal Equalizer, Decision Feedback Equalizer (DFE). Algorithms for Adaptive Equalization – Zero Forcing, LMS, and RLS. Problem solving.
Diversity Techniques: Realization of Independent Fading Paths, Receiver Diversity – System Model, Selection Combining, Threshold Combining, Maximal Ratio Combining, and Equal Gain Combining, Rake receiver. Transmit Diversity–Channel known at Transmitter, Channel unknown at Transmitter – the Alamouti Scheme, analysis.

UNIT–IV: MULTIPLE ACCESS TECHNIQUES & NETWORKING (Periods:11)

Introduction to Multiple Access: FDMA, TDMA, CDMA, SDMA, Packet Radio- Pure ALOHA, Slotted ALOHA, CSMA, and Reservation protocols. Capacity of Cellular Systems-Cellular CDMA. Problem Solving.

Introduction to Wireless Networking: Introduction to Wireless Networks, Differences between Wireless and Fixed Telephone Networks, Development of Wireless Networks, Traffic Routing in Wireless Networks, Wireless Data Services, Common Channel Signaling.

UNIT – V: MULTICARRIER MODULATION (Periods:11)

Data Transmission using Multiple Carriers, Multicarrier Modulation with Overlapping Sub channels, Discrete Implementation of Multicarrier Modulation –

DFT and its properties, The Cyclic Prefix, Orthogonal Frequency Division Multiplexing (OFDM), Matrix Representation of OFDM, Vector Coding. Challenges in Multicarrier Systems. Problem solving.

MIMO and multicarrier modulation: Narrowband MIMO model-parallel decomposition of MIMO channel-MIMO channel capacity-MIMO diversity gain –data transmission using multiple carriers multicarrier modulation with overlapping sub channels-mitigation of subcarrier fading.

Total periods: 55

TEXT BOOKS:

1. T. S. Rappaport, "Wireless Communications, Principles and Practice," Prentice Hall, 2nd edition, 2002.
2. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005.

REFERENCE BOOKS:

1. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communications," Cambridge University Press, 2006.
2. Dr. KamiloFeher, "Wireless Digital Communications," Prentice Hall, 1995.
3. Raj Pandya, "Mobile and Personal Communication Systems and Services," Prentice Hall of India, 2002.
4. William C.Y. Lee, "Wireless and Cellular Telecommunications," McGraw-Hill, 3rd edition, 2006.

M. Tech. -II Semester
(16MT23806) DISPLAY TECHNOLOGIES AND DEVICES
(PE-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Semiconductor Devices and Circuits at UG Level.

COURSE DESCRIPTION:
Introduction to display optics, Inorganic display technologies; Measurements of display systems; Characteristics of liquid crystal display, thin film transistor, Active matrix LCD and organic LED Displays.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Gain in-depth knowledge in
   - Display Optics
   - Display Technologies
   - Display Measurements.
2. Analyze problems in Measurements of parameters in display systems.
3. Conceptualize and implement various displays to address complex engineering problems for wide range of solutions in different display technologies.
4. Apply appropriate tools, models and technologies to enhance visualization in display Devices.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO DISPLAY OPTICS (Periods: 10)
Light, Modulation of Light, Human vision and perception for display – Performance of the Human Visual system, Red -Green-Blue (RGB) color gamut, chromaticity, energy transfer, energy absorption, optical emission, Luminescence, Photoluminescence(PL), Cathodo-luminescence (CL), Electroluminescence (EL).

UNIT-II: INORGANIC DISPLAY TECHNOLOGY (Periods: 12)
Cathode-ray tube (CRT) display, flat-panel display; field emission display (FED), plasma display panel (PDP), semiconductor light-emitting diode (LED) display Projection Displays, Near-to-Eye Displays.

UNIT-III: DISPLAY MEASUREMENTS (Periods: 10)
Measurement Equipment, Display Measurement System, Photometry, Evaluation Parameters, Photometric Measurements, Photometric Variation, Colorimetry, Operative Characteristics, Colorimetric Measurements, Solid Color Control and Gray Patch Control.

UNIT-IV: LIQUID CRYSTAL Displays AND TFT (Periods: 12)
Liquid Crystal – Liquid Crystal Materials, Liquid Crystal Alignment, Isotropic, Nematic and Smectic phases, Twisted Nematic cell, In-plane switching, Fringe Filed switching.
Thin film transistors (TFT) – Basic Concepts of Crystallized semiconductor Materials, Disordered Semiconductors, TFT Characteristics.

UNIT-V: AMLCD and OLED (Periods: 11)
Active matrix liquid crystal display (AMLCD) - structure of AMLCD, Operating Principles of AMLCD, drive circuit, addressing method, fabrication of AMLCD, Performance characteristics.
Organic light emitting diode (OLED), organic semiconductor, device structure and performance, electrical and optical Characteristics of OLEDs.

Total Periods: 55

TEXT BOOKS:

1. John Wilson and John Hawkes, "Optoelectronics: An Introduction", Prentice Hall, 3rd edition, 1998.
2. Jiun-Haw Lee, david N.Liu, Shin-Tson Wu, "Introduction to Flat Panel Displays", John Wiley & Sons, 2008.
3. Matthew S.brennesholtz, Edward H.stupp, "Projection Displays", John Wiley & Sons, 2008.

REFERENCE BOOKS:

1. Willem den Boer, "Active Matrix Liquid Crystal Displays", Elsevier, 2005.
2. Jan Kalinowski, "Organic Light-Emitting Diodes", Marcel Dekker, 2005.
3. David Armitage, Ian Underwood and ShinTson Wu, "Introduction to Microdisplays", John Wiley & Sons Ltd, 2006.
4. Robert L.Myers, "Display Interfaces: Fundamentals and Standards", John Wiley & sons, 2003.

M. Tech. -II Semester
(16MT23807) OPTICAL COMMUNICATIONS AND NETWORKS
(PE-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PREREQUISITES: --

COURSE DESCRIPTION:
Non linear properties of fibers; characteristics of fiber materials; optical cable design and connectors; optical components; modulation and demodulation schemes; error detecting and correcting codes; optical network management and control.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate Knowledge in
   - Linear and Non-linear Characteristics of Optical fiber.
   - Fiber design considerations.
   - Minimization of Losses in Cable design.
   - Understanding the operation of advanced fiber optic components.
   - Modulation and demodulation techniques.
   - Access networks.
   - Network Control and Management.
2. Analyze complex engineering problems critically in the domain of optical communication for conducting research.
3. Design of optical cable and transmission layer in the field of optical Communications.
4. Solve engineering problems related to optical communication to meet societal and industrial needs.
5. Apply appropriate techniques to complex engineering activities in the field of optical communications.

DETAILED SYLLABUS:

UNIT I: INTRODUCTION (Periods:11)
Evolution of fiber types, guiding properties of fibers, cross talk between fibers, coupled modes and mode mixing, dispersion properties of fibers, nonlinear effects of optical fibers- SRS, SBS, intensity dependent refractive index. Characterizations of materials for fibers, fiber preform preparation- Soot deposition, MCVD. Fiber drawing and control, roles of coating and jacketing.

UNIT II: OPTICAL CABLE DESIGN (Periods:10)
Fiber design considerations-Fiber diameter, Cladding thickness, Low and high bit rate systems. Design objectives and cable structures, Fiber splicing- fiber end preparation, single and array splices, measurement of splicing effects. Optical fiber connectors-The role of connectors, Connector alignment techniques.

UNIT-III: FIBER OPTIC COMPONENTS FOR COMMUNICATION AND NETWORKING (Periods:15)
Couplers, Isolators and Circulators, Multiplexers & filters- Bragg Gratings, Fabry-Perot Filters, Mach-Zehnder Interferometers, Arrayed Waveguide Grating, Acousto-Optic Tunable Filter, High Channel Count Multiplexer Architectures. Optical Amplifiers- Erbium Doped Fiber amplifiers, Raman amplifiers, Transmitters- LED, Lasers, Direct and External Modulation, Detectors- Photo detectors. Optical Switches – Large Optical Switches. Wavelength Converters – Optoelectronic Approach, Optical gating.

UNIT-IV: MODULATION AND DEMODULATION (Periods:8)

Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duo binary, Single Side Band and Multilevel Schemes, Demodulation- Ideal and Practical receivers, Bit Error Rates, Coherent Detection, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.

UNIT-V: OPTICAL NETWORKS & MANAGEMENT (Periods:10)

Access Networks - architecture overview, Enhanced HFC, Fiber to the curb (FTTC). Photonic packet switching - OTDM, Synchronization. Deployment considerations - Designing the transmission layer using SDM, TDM, WDM, Unidirectional versus Bidirectional WDM Systems.

Control and Management- Network Management functions, Performance and fault management, Configuration Management, Optical Safety.

Total Periods: 54

TEXT BOOKS:

1. S. E. Miller, A. G. Chynoweth, "Optical Fiber Telecommunication", 1979.
2. Rajiv Ramaswamy, Kumar N. Sivaranjan and Galen H. Sasaki, "Optical Networks", Elsevier, 3rd edition, 2010.

REFERENCE BOOKS:

1. Govind P. Agarwal "Fiber–Optic Communication Systems", Wiley India, 3rd edition, 2002.
2. Gerd Kaiser, "Optical Fiber Communication", McGraw Hill, 4th edition, 2008.
3. John. M. Senior, "Optical fiber communications: Principles and Practice", Pearson, 3rd edition, 2010

M. Tech. -II Semester
(16MT23808) REAL TIME SYSTEMS
(PE-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
Courses on Digital system design, Operating systems and embedded systems.

COURSE DESCRIPTION:
Real time system reference model; Real time scheduling approaches; Fault tolerant real time systems; Real time operating system concepts; Commercial RTOS.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate advanced knowledge in
   - Characterizing Real Time Systems
   - Various Scheduling approaches
   - Fault tolerant techniques
   - Real Time Operating System Services
2. Analyze critically various Operating Systems using Contemporary bench marks.
3. Consider trade-offs in Real Time System designing to solve engineering problems to exhibit specific behavior, given a set of performance goals and technology.
4. Familiarize with fault tolerant and scheduling techniques to overcome ever increasing embedded system design complexity combined with reduced time-to-market window to revolutionize embedded system design process.
5. Initiate research in Real Time Systems.
6. Explore tools and derive pseudo code using RTOS, for developing efficient embedded Systems.
7. Carry out multidisciplinary research in designing RTOS based systems.

DETAILED SYLLABUS:

UNIT-I: REAL TIME SYSTEMS (Periods: 10)
Hard Vs Soft Real Time Systems, a Reference Model of Real Time Systems- Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency. Functional Parameters, Resource Parameters of Jobs and Parameters of Resources, Scheduling hierarchy.

UNIT-II: APPROACHES TO REAL TIME SCHEDULING (Periods: 10)
Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs Static Systems, Effective Release Times and Dead Lines, Optimality and Non-optimality of EDF and LST algorithms, Challenges in Validating Timing Constraints in Priority Driven Systems, Offline Vs Online Scheduling.

UNIT-III: (Periods: 12)
Scheduling Real Time Tasks in Multiprocessor and Distributed Systems: Multiprocessor task allocation, Dynamic allocation of tasks, Fault tolerant scheduling of tasks, Clocks in distributed Real Time Systems.
Fault Tolerance Techniques: Introduction, Failures- Causes, Types, Detection. Fault and Error Containment, Redundancy- Hardware, Software, Time. Integrated Failure Handling.

UNIT-IV: OPERATING SYSTEMS (Periods: 12)
Overview- Threads and Tasks, the Kernel. Time Services and Scheduling Mechanisms, Basic Operating System Functions- Communication and Synchronization, Event Notification and Software Interrupt Memory Management, I/O and Networking.

Processor Reserves and Resource Kernel, Capabilities of Commercial Real Time Operating Systems.

UNIT-V: COMMERCIAL REAL TIME OPERATING SYSTEMS (Periods: 12)

UNIX as RTOS - non preemptive kernel, Dynamic Priority levels and deficiencies. UNIX based Real Time Operating Systems - Extension to UNIX kernel, Host Target Approach, Preemption Point Approach, Self host systems. Windows as RTOS- features of Windows NT, Shortcomings, Windows NT vs UNIX. POSIX - Open software, Genesis of POSIX, Overview of POSIX, Real Time POSIX standard. Survey of Contemporary Real Time Operating Systems- PSOS, VRTX, VXworks, QNX, µC/OS-II, RT Linux, Lynx, Windows CE. Bench-marking Real Time Systems.

Total Periods: 56

TEXT BOOKS:

1. Jane W.S. Liu, "Real Time Systems", Pearson Education, 1st edition, April 2000.
2. C. M. Krishna, Kang G Shin, "Real Time Systems", McGraw-Hill Higher education, 1997.
3. Rajib Mall, "Real Time Systems-Theory and Practice", Pearson Education India, 1st edition, Nov.2012.

REFERENCE BOOKS:

1. Phillip A. Laplante and Seppo J. Ovaska, "Real-Time Systems Design and Analysis: Tools for the Practitioner", Wiley-IEEE Press, 4th edition, Nov. 2011.
2. Hermann Kopetz, "Real-Time Systems: Design Principles for Distributed Embedded Applications ", Springer; 2nd edition, 2011.

M. Tech. - II Semester
(16MT23809) SPEECH PROCESSING
(Common to DECS & CMS)
(PE-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: Courses on Signals & Systems and Digital Signal Processing in UG

COURSE DESCRIPTION:
Acoustic theory of speech production; Models for speech signals and speech processing systems; Mathematical analysis of speech signals - homomorphic and LPC models; Speech and speaker recognition systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge in
   - Digital model representation of speech signal
   - LPC analysis
   - Homomorphic models
2. Analyze complex engineering problems critically for conducting research in speech signal processing.
3. Solve engineering problems using efficient algorithms for feasible and optimal solutions in Speech signal processing field.
4. Initiate research in speech signal processing.
5. Apply speech and speaker verification techniques to complex engineering activities in the field of speech processing.
6. Contribute to scientific research in Speech and speaker identification and verification systems with objectivity and rational analysis.

DETAILED SYLLABUS:

UNIT-I: DIGITAL MODEL FOR THE SPEECH SIGNAL (Periods:13)
The process of speech production - the mechanism of speech production, acoustic phonetics. The Acoustic theory of speech production- sound propagation, uniform lossless tubes, Effect of losses in the vocal tract, Effect of radiation at the lips, Vocal tract transfer functions for vowels, the effect of nasal coupling, Excitation of sound in the vocal tract. Digital model for speech signals.

UNIT - II : TIME DOMAIN MODELS FOR SPEECH PROCESSING (Periods:10)
Introduction, Window considerations, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT-III: HOMOMORPHIC SPEECH PROCESSING (Periods:09)
Homomorphic systems for convolution – properties of the complex Cepstrum, computational considerations. The complex Cepstrum of speech, pitch detection, formant estimation, Homomorphic vocoder.

UNIT-IV : LINEAR PREDICTIVE CODING OF SPEECH (Periods:12)
Basic principles of linear predictive analysis – Auto correlation method, The covariance method. Computation of the gain for the model, solution of LPC Equations – Cholesky Decomposition solution for the covariance method. Durbin's Recursive solution for the autocorrelation equations. Comparison between methods of solutions of LPC analysis equations. Applications of LPC parameters – Pitch detection using LPC parameters, Formant analysis using LPC parameters.

UNIT-V: SPEECH AND SPEAKER RECOGNITION SYSTEMS (Periods:08)

Speaker recognition system-speaker verification system, speaker identification systems. Speech recognition system- isolated digit recognition system, continuous digit recognition system, LPC distance measure.

Total periods: 52

TEXT BOOKS:

1. L R Rabiner and SW Schafer, "*Digital processing of speech signal*s", Pearson Education, 2006.
2. LR Rabiner, BH Juang, B Yegnanarayana, "*Fundamentals of Speech Recognition*", Pearson Education, 1993.

REFERENCE BOOKS:

1. Thomas F Quateri, "*Discrete time speech signal processing*", Pearson edition, 2006.
2. Ben Gold & Nelson Morgan, "*Speech & audio signal processing*", wiley, 2006.
3. Douglas O Shaughnessy, "*Speech Communications*", Oxford university press, 2nd edition, 2000.

M. Tech. - II SEMESTER
(16MT23831) COMMUNICATIONS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

RE-REQUISITES: Simulation Lab at UG Level

COURSE DESCRIPTION:
Design and simulation of communication systems - QPSK communication system over AWGN channel, Baseband Direct Sequence Spread Spectrum (DS/SS) System; Generation of different density and distribution functions; Generation of maximal and Gold code sequences.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonsrate Knowledge in
   - Generation of Maximal and Gold Sequences & verification of their properties.
   - Design of communication system for band limited channels for Zero ISI.
   - Evaluating the performance of QPSK over AWGN Channel and Rayleigh Fading Channels.
   - Simulation of Code matched filter in Spread Spectrum Communication System.
   - Simulation of baseband Direct Sequence Spread Spectrum (DS/SS) System.
   - Performance evaluation of RAKE Receiver over Slow Fading Channel.
   - Simulation of Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Doppler Spreads.
2. Analyze engineering problems for feasible and optimal solutions in the core area of communication.
3. Design of Matched filter for spread spectrum communications.
4. Use MATLAB Toolbox to simulate complex engineering activities in the field of communication.
5. Demonstrate knowledge and understanding of engineering principles to execute the Projects effectively in the field of communications.

LIST OF EXERCISES:
1. Generation of discrete time independent and identically distributed (IID) random processes with different distributions (Bernoulli, Binomial, Geometric, Poisson, Uniform, Gaussian, Exponential, Laplacian, Rayleigh, Rician). (1 time slot)
2. Communication system Design for Band limited Channels: System design for Zero ISI. (2 time slots)
3. Equalization of Multipath Channel using LMS or RLS Algorithms. (1 time slot)
4. Performance Evaluation QPSK communication system over AWGN channel. (1 time slot)
5. Generation of Maximal sequences & Gold codes and verification of their correlation properties. (2 time slots)
6. Design and simulation of code matched filter in spread spectrum communication system. (1 time slot)
7. Design and simulation of baseband Direct Sequence Spread Spectrum (DS/SS) System. (1 time slot)
8. Simulation of Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Doppler Spreads (Ex. 50 Hz and 100 Hz). (2 time slots)
9. Performance Evaluation of RAKE Receiver over Slow Fading Channel. (2 time slots)
10. Performance Evaluation of QPSK System over Rayleigh Fading Channel. (1 time slots)

Total Time Slots: 14

Tools:

Numerical Computing Environments–GNU Octave or MATLAB or any other equivalent tool

REFERENCE BOOKS:

1. W.H. Tranter, K. Sam Shanmugham, T.S. Rappaport, and K.L. Kosbar, *Principles of Communication System Simulation with Wireless Applications,* Pearson, 2004.
2. J.G. Proakis, and M. Salehi, *Contemporary Communication Systems using MATLAB,* Book ware Companion Series, 2006.
3. John G. Proakis, "DIGITAL COMMUNICATIONS", McGraw Hill, 4th edition, 2001.

M. Tech. – II Semester
(16MT23832) EMBEDDED SYSTEMS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PRE-REQUISITES: Digital Logic Design, C-Programming, Embedded System Design Courses at UG Level

COURSEDESCRIPTION: MSP430 Programming; Timers; Interrupts; Parallel and Serial Ports; ADC; SPI; Applications

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate knowledge in on-chip resources available in MSP430 Based microcontrollers such as: Parallel Ports, Timers, ADC, Serial ports.
2. Analyze critically various on-chip resources, programming alternatives towards efficient system design.
3. Solve complex engineering problems in embedded domain.
4. Design embedded systems using microcontrollers such as the MSP430.
5. Initiate research in embedded system design.
6. Contribute positively to multidisciplinary scientific research in Embedded domain.
7. Communicate effectively in verbal and written forms.

List of Experiments:

1. Study of MSP430 based Development Environment (1 Slot)
2. Read input from switch and Automatic control/flash LED (software delay)(1 Slot)
3. Digital input and Output using parallel ports (1 Slots)
4. Watchdog timer as interval Timer (1 Slots)
5. Timer Application: Measurement in capture mode and output in continuous mode (2 Slots)
6. Setting real time clock: state machines (1 Slots)
7. Configuring and usage of interrupts (1 Slot)
8. Measurement of frequency (1 slot)
9. Generation of precise frequency (1 Slot)
10. PWM Generator (1 Slot)
11. SPI with USI and USCI (2 Slots)
12. ADC (1 Slot)

Total Time Slots: 14

TEXT BOOK:

1. Chris Nagy, "Embedded Systems Design using the TI MSP430 Series", Embedded Technology Series, Newness Imprint, Elsevier Publications, 2003

REFERENCE BOOK:

1. John Davies, "MSP430 Microcontroller Basics", Newness Imprint, Elsevier Publications, 1st edition, Aug. 2008

M. Tech. -II Semester
(16MT23833) SEMINAR

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
--	100	100	--	--	--	2

PRE-REQUISITES:--

COURSE DESCRIPTION:
Identification of seminar topic; literature survey; preparation of technical report and presentation.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate capacity to identify an advanced topic for seminar in core and allied areas.
2. Extract information pertinent to the topic through literature survey.
3. Comprehend extracted information through analysis and synthesis critically on the topic.
4. Plan, organize, prepare and present effective written and oral technical report on the topic.
5. Adapt to independent and reflective learning for sustainable professional growth in Digital Electronics and Communication Systems.
6. Contribute to multidisciplinary scientific work in the field of Digital Electronics and Communication Systems.
7. Understand ethical responsibility towards environment and society in the field of Digital Electronics and Communication Systems.
8. Engage in lifelong learning for development of technical competence in the field of Digital Electronics and Communication Systems.

M. Tech. – II Semester
(16MT23810) INTELLECTUAL PROPERTY RIGHTS
(Common to all M. Tech. Programs)
(Audit Course)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	-	2	-	-

PRE-REQUISITES: --

COURSE DESCRIPTION:

Introduction to Intellectual Property; Trade Marks; Law of Copy Rights; Law of Patents; Trade Secrets; Unfair Competition; New Development of Intellectual Property.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on
   - Intellectual Property
   - Trade Marks & Secrets
   - Law of Copy Rights, Patents
   - New development of Intellectual Property
2. Analyze the different forms of infringement of intellectual property rights.
3. Solve problems pertaining to Intellectual Property Rights.
4. Stimulate research zeal for patenting of an idea or product.
5. Write effective reports required for filing patents.
6. Develop life-long learning capabilities.
7. Develop awareness of the relevance and impact of IP Law on their academic and professional lives.
8. Develop attitude for reflective learning.

DETAILED SYLLABUS:

UNIT - I: Introduction to Intellectual property (Periods:5)
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT - II: Trade Marks: (Periods:5)
Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT - III: Law of copy rights: (Periods:6)
Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT - IV: Trade Secrets: (Periods:6)
Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, False advertising.

UNIT - V: New development of intellectual property: (Periods:6)

New developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Total Periods: 28

REFERENCE BOOKS:

1. Deborah, E. Bouchoux, *Intellectual property right*, Cengage learning.
2. Prabuddha ganguli, *Intellectual property right - Unleashing the knowledge economy*, Tata Mc Graw Hill Publishing Company Ltd.

M. Tech. -III & IV Semester
(16MT33831 & 16MT43831) PROJECT WORK

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
200	200	400	-	-	-	28

PRE-REQUISITES:--

COURSE DESCRIPTION:
Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Writing of thesis and presentation.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate capacity to identify an advanced topic for project work in core and allied areas.
2. Extract information pertinent to the topic through literature survey.
3. Comprehend extracted information through analysis and synthesis critically on the topic.
4. Solve engineering problems pertinent to the chosen topic for feasible solutions.
5. Use the techniques, skills and modern engineering tools necessary for project work.
6. Do time and cost analysis on the project.
7. Plan, prepare and present effective written and oral technical report on the topic.
8. Adapt to independent and reflective learning for sustainable professional growth.
9. Contribute to multidisciplinary scientific work in the field of Digital Electronics and Communication Systems
10. Understand ethical responsibility towards environment and society in the field of Digital Electronics and Communication Systems.
11. Engage lifelong learning for development of technical competence in the field of Digital Electronics and Communication Systems.