ACADEMIC REGULATIONS,

COURSE STRUCTURE

AND

DETAILED SYLLABUS

FOR

B.Tech - ECE III & IV Year

(Applicable for the Batches admitted from 2020-2021)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SREENIDHI INSTITUTE OF SCIENCE AND TECHNOLOGY

(An Autonomous Institution under JNTUH)

Accredited by NAAC with 'A' Grade and accredited by NBA)

(Recipient of TEQIP under The World Bank Assistance)

Yamnampet, Ghatkesar, Hyderabad– 501301.

January 2021

VISION AND MISSION OF THE INSTITUTION

Vision

To emerge as a leading Institute for Technical Education and Research in India with focus to produce professionally competent and socially sensitive engineers capable of working in multidisciplinary global environment.

Mission

1. To train the students in the fundamentals of Engineering, Science and Technology by providing good academic environment to pursue undergraduate, Post graduate in chosen fields of Engineering and Technology for a successful professional career.

2. To be a continuous learning organization by developing strong liaison with Academia, R & D institutions and Industry for exposure in practical aspects of engineering and providing solutions to the industrial and societal problems for sustainable development. To imbibe skills for entrepreneurship, project and finance management.

3. To inculcate team work, leadership, professional ethics, use of modern tools, IPR issues so that graduates are encouraged to obtain patents and respond to competitive global environment.

4. To promote strong research culture in graduates for lifelong learning, to explore the frontiers of knowledge and present at technical fora/publish in Journals at national/international level.

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

Department of Electronics and Communication Engineering is established in the year 1997 to meet the requirements of the emerging industry/discipline. The Vision and the Mission of the department are:

VISION

To create an educational environment for students to excel in their professional carrier, and to solve the challenges of industry in the field of Electronics and Communication Engineering with focus on human values, professional ethics and social responsibility.

MISSION

1. Training the students in the core subjects of Electronics and Communication engineering with due focus on multi-disciplinary areas.

2. Establishing liaison with relevant industries, R&D organizations and renowned academia for exposure to modern tools and practical aspects of technology.

3. Inculcating team work, leadership, professional ethics, effective communication and interpersonal skills to make students globally competent in employment as well as entrepreneurship.

4. Promoting scientific temper and research culture in the graduates towards lifelong learning, and to work towards the engineering solution in the contexts of society and environment.

Program Educational Objectives (PEOs)

PEO – I. To apply the knowledge of mathematics, science and engineering fundamentals to find the solution of complex engineering problems concerning societal, health, safety, cultural and environmental issues.

PEO – II. Empowering graduates to exhibit proficiency in core areas through evolving technologies in electronics and communication engineering and to identify, analyze, design, and conduct experiments for innovative solutions.

PEO – III. Facilitating graduates to achieve academic excellence and pursue R&D in multi-disciplinary domains leading to design of novel products using modern tools and to promote skills in project management, entrepreneurship and IPR.

PEO- IV. Developing human values, and professional ethics, improving the effective communication skills, team work, leadership qualities, and life-long learning.

The Program Outcomes

Engineering Graduates will be able to:

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

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

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

The Program Specific Outcomes (PSOs)

PSO1: Should be able to gain the in-depth knowledge in core subjects to identify, formulate, analyze, and suggest viable solutions to the real-life problems in the field of electronics and communication engineering.

PSO2: Should have the capability to apply modern design tools to analyze and design subsystems/processes for a variety of applications in the allied fields of electronics and communications.

PSO3: Should possess good interpersonal skills, and also an ability to work as a team member as well as team leader with good professional ethics, and also to become a life-long learner in the context of technological developments.

ACADEMIC REGULATIONS
FOR B.TECH. REGULAR STUDENTS
WITH EFFECT FROM
THE ACADEMIC YEAR 2020-21
(A-20)

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

1.1 SNIST offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) with effect from the academic year 2020-21 in the following branches of Engineering.

Sl. No.	Branch
1.	Civil Engineering
2.	Electrical and Electronics Engineering
3.	Mechanical Engineering
4.	Electronics and Communication Engineering
5.	Computer Science and Engineering
6.	Information Technology
7.	Electronics and Computer Engineering

1.2. Credits (Semester system for B.Tech courses)

The existing credit system of giving one credit for a lecture hour/ tutorial hour per week and giving 0.5 credit for every hour of practical and drawing shall be continued in these regulations also.

2.0 Eligibility for admission

2.1 Admission to the Under Graduate courses shall be made either on the basis of the rank of the candidate in entrance test conducted by the Telangana State Government (EAMCET) or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time. However, admissions under Management / NRI Category shall be made on the relevant orders issued by the Govt. of Telangana from time to time.

2.2 The medium of instruction for the entire Under Graduate programme of study in E&T will be **English** only.

3.0 B.Tech. Programme structure

3.1 A student after securing admission shall pursue the Under Graduate programme in B.Tech. in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course. However, the student can take two more years for appearing the examinations to clear the backlog subjects.

In the First year it is structured to provide **45 credits** and the credits in II , III and IV years should not exceed **119 credits** as per AICTE model curriculum for the B.Tech. programme. Each student

shall secure **164 credits** (with CGPA ≥5) required for the completion of the Under Graduate programme and Award of B.Tech degree.

Each student shall secure **164 total credits** (with CGPA ≥ 5) for the completion of the Under Graduate programme for the award of the B.Tech. degree. However, any revision made in this regard and approved by the Academic Council of the college and by Parent University shall be implemented from the date of the revision.

3.2 **UGC/AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations stated below.

3.2.1 Semester scheme

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

Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated curriculum / course structure as suggested by AICTE are followed.

3.2.2 Credit courses

- A student in a semester has to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.
- One credit for one hour/ week offered in the entire semester for theory lecture (L) / Tutorial (T) courses.
- One credit for two hours/ week offered in the entire semester for laboratory/ practical (P) courses.
- The orientation course recommended by AICTE in the model curriculum is offered for 3 weeks and Cyber Security in III year as mandatory course.
- Environmental Engineering is offered mandatory course for B. Tech Mechanical Engineering and ECE students in II year.
- However,these courses will be reflected in the Memo of Marks,the grading will be awarded below, with some total of 100 marks with CIE for 30 marks and SEE for 70 marks.

%of Marks Secured ina Subject/Course	LetterGrade
Greater thanorequalto90%	O (Outstanding)
80and lessthan 90%	A+ (Excellent)
70and lessthan 80%	A (VeryGood)
60and lessthan 70%	B+(Good)
50and lessthan 60%	B (Average)
40and lessthan 50%	C (Pass)
Below40%	F (FAIL)
Absent	Ab

- For mandatory courses i.e ., **Orientation Course** for B. Tech I year students to be taught for one week in I semester with Two Units and remaining Four Units in B. Tech. I year II semester and **Cyber Security** is offered as mandatory course for all the students of Civil, ME,EEE and will not have credits, but evaluation will be done as per the above table. A student cannot obtain degree unless he / she completes all the mandatory courses.

3.2.3 Subject Course Classification

All subjects / courses offered for the Under Graduate programme in E&T (B.Tech. Degree programmes) are broadly classified as follows. The Institution has followed all the guidelines issued by AICTE/UGC.

The groups of the subjects shall be as given in the table hereunder along with the credits suggested by AICTE. efforts are made by individual departments to make up the total credits equal to 164.

Sl. No.	Category	Suggested Breakup of Credits (Total 160)	CSE	ECE	CED	EEE	ME	IT	ECM
1	Humanities and social sciences including Management courses	12*	14	14	11	13	13	14	13
2	Basic Science including Mathematics courses	25*	22	23	29	30	24	22	26
3	Engineering Science courses including workshop, drawing, basic electrical /electronics mechanical course as well as various computer courses offered for Non – IT branches	24*	29	28	31	25	28	29	28
4	Professional core courses	48*	59	59	51	61	62	59	59
5	Professional Elective courses (five courses)relevant to chosen specialization / branch	18*	15	15	15	15	15	15	15
6	Open Electives(3 courses) offered by any other departments / MBA department **	18*	6	6	6	6	6	6	6
7	Project work, seminar and internship in industry or elsewhere	15*	19	19	21	14	16	19	17
8	Mandatory courses (Environmental Sciences, Induction training, Indian constitution, Essence of Indian Traditional Knowledge)	(Non-credit)	(Non-credit)	(Non-credit)	(Non-credit)	(Non-credit)	(Non-credit)	(Non-credit)	(Non-credit)
	Total	160*	164	164	164	164	164	164	**164**

The Joint Board of Studies and Academic Council of the institution has approved the total number of credits to be 164. The various groups of subjects mentioned above shall have credits suggested above with minor variations.

4.0 Course registration

4.1 A 'faculty advisor or counselor' shall be assigned to a group of 20 students, who will advise student about the under graduate programme, its course structure and curriculum, choice/option for Professional and open Electives based on their employment potential / further studies.

4.2 The student will progress semester after semester as the Institute is following cohort system to satisfying the conditions of promotion to the next semester.

4.3 **In the present system there shall be five subjects in each professional elective stream and three subjects in open elective stream.** A student can opt for a stream of professional/ open electives which should be submitted to the faculty Advisor/ Counselor and copy of it to the Examination Section through the Head of the department. A copy of it will be retained with the Head of the department/ faculty Advisor/ Counselor and the student.

4.4. **The student can take one extra subject in each semester and can complete the program in 3 ½ years but original degree will be issued along with his / her batch mates after 4 years.**

4.5. **If a student acquires 20 credits extra than the required credits as per the regulations he will be awarded honors.**

4.6 The purpose of offering Elective Streams in both Professional and Open Electives is to facilitate the students to have a minor specialization based on their interest, so that they will have multi disciplinary exposure. Hence, a student is to take a stream of Electives in either in Professional / Open Elective. He shall not be permitted to opt for other elective subjects in other streams in subsequent semesters.

4.7 Dropping of Electives may be permitted, only after obtaining prior approval from the faculty advisor / counselor, '**within a period of 15 days** from the beginning of the current semester.

5.0 Subjects / courses to be offered

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

5.2 A subject / course may be offered to the students, **only if** a minimum of **30 students** opt for it. The maximum strength of a section is limited to 80.

6.0 Attendance requirements:

6.1 A student shall be eligible to appear for the semester end examinations, if student acquires a minimum of 75% of attendance in aggregate of all the subjects / courses (excluding attendance in mandatory courses, Internship during II year, NCC / NSO and NSS) for that semester.

6.2 Shortage of attendance in aggregate upto 10% (65% and above and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable towards condoning of shortage of attendance as decided by finance committee of SNIST from time to time.

6.4 Shortage of attendance below 65% in aggregate shall in**NO CASE** be condoned.

6.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester.

They get detained and their admission for that semester shall stand cancelled.

They will not be promoted to the next semester. They may seek re-admission for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and / or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category. He will be governed by the new regulations in which he takes re-admission.

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

7.0 Academic requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.6.

7.1 **A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject / course, if student secures not less than 35% marks (24 out of 70 marks) in the semester end examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that subject / course.**

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to group projects, seminar, comprehensive test, viva-voce and major project.If a student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them.

The student would be treated as failed, if student

(i) does not complete all the mandatory courses offered during the course
(ii) doesnot submit a report on internship, group project, major project, or does not make a presentation of the same before the evaluation committee as per schedule, or
(iii) does not present the seminar as required in the I year and II year or
(iv) secures less than 40% marks in comprehensive test and seminar/ comprehensive test and viva-voce /group project/major project evaluations.

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

7.3 Promotion Rules based upon credits

S.No.	Promotion	Conditionstobefulfilled
1	First year First Semester to Second Semester	Regularcourseofstudyoffirstyear firstsemester and should have satisfied the minimum requirement of attendance to appear I year I semester.
2	Firstyearto secondyearfirstsemester	i. Regularcourseofstudyoffirstyear First and secondsemesters. ii. Musthavesecuredat least50%ofcredits (22) upto first year second semester from alltherelevantregularand supplementary

		examinations, whetherthestudent takesthose examinationsornot.
3.	II Year I Semester to II Semester	Regularcourseofstudyof second year firstsemester.
4	Second year tothirdyearfirstsemester	i. RegularcourseofstudyofFirst and secondsemesters of second year. ii. Must have secured at least 60%of credits (54) uptosecond yearsecond semester fromalltherelevant regular andsupplementary examinations, whetherthestudent takesthoseexaminationsornot.
5	Third year first semester to secondsemester	Regularcourseofstudyofthirdyear firstsemester.
6	Thirdyearsecondsemesterto fourthyearfirstsemester	i. Regular course of study of third yearsecondsemester. ii. Must have secured 60% ofcredits (79) uptothirdyear second semester fromalltherelevant regular andsupplementary examinations, whetherthestudent takesthoseexaminationsornot.
7	Fourth year first semester to fourthyearsecond semester	Regularcourseofstudyoffourthyear firstsemester.

7.4 A student (i) shall attend for all courses / subjects covering 164 credits as specified and listed in the course structure, (ii) fulfils all the attendance and academic requirements for 164 credits, (iii) earn all 164 credits by securing SGPA $\geq$ 5.0 (in each semester), and CGPA (at the end of each successive semester) $\geq$ 5.0, (iv) **passes all the mandatory courses,** to successfully complete the under graduate programme. The performance of the student in these 164 credits shall be taken into account for the calculation of 'the final CGPA (at the end of under graduate programme), and shall be indicated in the grade card of IV year II semester.

7.5 If a student registers for some more '**extra subjects'** (in the parent department or other departments / branches of engineering) other than those listed subjects as specified in the course structure of his Department, the performances in those ' **extra subjects**' will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects'** registered, Percentage (%) of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in the regulations 6 and 7.1 to 7.4 above.

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

7.7 A student **detained in a semester due to shortage of attendance, may be re-admitted when the same semester is offered in the subsequent academic years for the fulfillment of academic requirements**.

The academic regulations under which student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which student has been detained.

7.8 A student detained **due to lack of credits, will be promoted to the next academic year only after acquiring the required credits as per academic regulations.**

The academic regulations shall be applicable to a student whatever they are in force at the time of re-admission.

8.0 Evaluation - Distribution and weightage of marks

8.1 The performance of a student in each semester shall be evaluated subject-wise for a maximum of 100 marks for a theory and 100 marks for every practical subject with 30 marks Continuous Internal Evaluations (CIE) and 70 marks for Semester End Examinations (SEE)

Summer Break: Internship-I and Internship-II will be organized during summer vacation of II-II and III-II and evaluation of the same will be carried out during lab examinations of III-I and IV-I.

In addition, there will beGroup Project-I in III year I semester, Group Project-II in III year II semester, and Group Project-III in IV year I semester, Major project in IV year II semester will be evaluated for 100 marks.

The pattern of continuous internal evaluation for Internship Project and Group Project is given below:

Sl.No	Description	Marks
1	Abstract, Design, implementation and Presentation in front of Project Review Committee consisting of HoD, Senior faculty and Internal guides (Average)	15 marks
2	Report	05 marks
3	Evaluation by Internal Guide	10 marks
	Total sessional marks	**30 marks**

Semester end examination - 70 marks

Pattern of external evaluation for Internship Project and Group Project.

Sl.No	Description	Marks
1	Final report	10 marks
2	Presentation	10 marks
3	Demonstration/defence of project	50 marks
	Total sessional marks	**70 marks**

Pattern of continuous internal evaluation for Major Project in IV year II semester is as follows:

Sl.No	Description	Marks
1	Progress of Project work and the corresponding interim report as evaluated by Project Review Committee at the end of 6 weeks	5 marks
2	Seminar at the end of 6 weeks	5 marks
3	Progress of Project work as evaluated by Project Review Committee at the end of 11 weeks	5 marks
4	Seminar at the end of 11 weeks	5 marks
5	Evaluation by Project Review Committee at the end of 15 weeks and Final Project Report	5 marks
6	Final presentation and defense of project	5 marks
	Total	**30 marks**

Pattern of External Evaluation for Major project - 70 Marks

Sl.No	Description	Marks
1	Final Project Report	10 marks
2	Presentation	20 marks
3	Demonstration / Defense of Project before committee	40 marks
4	**TOTAL**	**70 marks**

8.2 For all the other theory and lab subjects the distribution of marks shall be 30 for Continuous Internal Evaluation (CIE) and 70 for the Semester End-Examination (SEE).

8.3 Theory Subjects

8.3.1 Pattern for Continuous Internal Evaluation (CIE) 30 marks

The following procedure is to be adopted for awarding internal marks of 30 for all the B. Tech. students from the **Academic Year 2020-2021**

The distribution of marks for continuous internal evaluation (30 marks) is shown below. Average of two Mid Tests will be taken for final award of marks.

a)	**Part – A** of Mid Test will have 10 questions	5 marks
b)	**Part – B** of Mid Test will have 4 questions (1 from each unit and 4th question from any one unit or combination) and student has to answer 3 questions	15 marks
c)	**Part – C** Mid Test Question Paper Will have 3 questions – One fromeach unit taken from assignment questions. Student has to answer 1 question out of 3 questions	3 marks
d)	**Assignment– I** three questions from each unit (1,2,3 unit) – total of 9 questionsto be submitted before first mid test. **Similarly assignment – II**: will have three questions from each unit (4, 5, 6 units) total of 9 questions will be submitted before Mid Test IIand average of two assignments will be considered.	2 marks
e)	Attendance *	3 marks
f)	Class notes	2 marks
	Total	**30 marks**

* Three marks are awarded for each theory subject for the students who put in attendance in a graded manner as given below:

S.No.	Attendance Range	Marks Awarded
1.	65 % and above but less than 75%	1
2.	75% and above and less than 85%	2
3.	85% and above	3

Marks for attendance shall be added to each subject based on average of attendance of all subjects put together.

If any candidate is absent in any subject or mid-term examination, this student wishes to improve performance, a **third mid-test** will be conducted for that student by the Institution in the entire syllabus, on the same day of Semester End Examination (SEE) for $2^1/_2$ hours. That result will be treated as III mid

test and average of better two of (mid test I,II,III) will be considered. III mid test will have Part-A (compulsory) and Part-B with essay type questions and three out of four questions are to be answered.

b) Pattern for External Examinations - (70 marks)

- There shall be external examination in every theory course and consists of two parts (Part-A & Part-B). The total time duration for this semester end examination will be 3 hours.

- **Part-A** shall have 20 marks, which is compulsory. It will have 10 short questions set with 2 marks each. There shall be atleast one question to each of the six units and two questions from units 1,2,3 and two questions from unit 4,5,6 and number of questions from any unit shall not exceed two.

- **Part-B** of the question paper shall have essay type questions for 50 marks and shall have 8 questions out of which any 5 are to be answered. At least one question must appear from each Unit. Seventh question must have 2 to 3 bits taken from 1st, 2nd, and 3rd units and 8th question also with 2 to 3 bits taken from 4th, 5th and 6th units, such that not more than 2 questions shall be from any one unit. All the questions carry equal marks.

8.4 Pattern of Evaluation for Lab subjects - (100 marks)

8.4.1 For practical subjects there shall be a continuous evaluation during the semester for 30 sessional marks and 70 marks for semester end examination. Out of the 30 marks for Continuous Internal Evaluation, the distribution of marks is as follows

S. No	Item	Marks
1.	Day to Day work	05 marks
2.	Final Record and viva	09 marks
3.	Average of two tests including viva	05 marks
4.	Lab Based Project Report viva and demo	08 marks
5.	Attendance	03 marks
	Total	**30 marks**

8.4.2 The semester end examination for 70 marks for the lab subjects shall be conducted by an external examiner and an internal examiner appointed by the Chief Superintendent of Examinations of the college. The marks are distributed as follows:

S. No	Item	Marks
1.	Procedure to experiment and Tabulation	10 marks
2.	Conduct of experiment, observation, Calculation	30 marks
3.	Results including graphs, discussions and conclusion	20 marks
4.	Viva voce and Record	10 marks
	Total	70 marks

8.4.3 In case computer based examinations

S. No	Item	Marks
1.	Flow chart and algorithms	10 marks
2.	Program writing and execution	30 marks
3.	Result and conclusions	20 marks
4.	Viva voce and Record	10 marks
	Total	70 marks

8.5 **For the subject having design and / or drawing, (such as Engineering Drawing and Machine Drawing), the distribution shall be 30 marks for internal evaluation (10 marks for day-to-day work including drawing,3 marks for home assignment work, 12 marks for average of two internal tests and 2 marks for class notes 3 marks for attendance) and 70 marks for end semester end examination.**

There shall be two internal tests in a Semester and the average of the two shall be considered for the award of marks for internal tests.

Third test facility can be availed as mentioned above (8.3.1 (i) (a) and (b)

8.6. Technical Seminar

There shall be a technical seminar evaluated for 100 marks from I year I semester to II year II Semester. The evaluation is purely internal and will be conducted as follows:

Sl.No	Description	Marks
1	Literature survey, topic and content	10
2	Presentation including PPT	10
3	Seminar Notes	05
4	Interaction with audience after presentation	05
5	Final Report 3 copies	10
6	Class room participation	05
7	Punctuality in giving seminar as per Scheduled time and date	10
8	Mid Semester Viva (on the seminar topics completed up to the end of 9th week	15
9	End Semester Viva	30
	Total	**100 Marks**

Student must secure 40% i.e. 40 marks to be successful in sum total (Hundred Marks) in Technical Seminar.

8.7 Comprehensive Test and Viva-voce:

Comprehensive test and Viva Voce	The subjects studied in the Semester concerned related to branches concerned and for placements
B.Tech I year I semester	I semester
B.Tech I year II semester	I and II semester
B.Tech II year I semester	I, II and III semester
B.Tech II year II semester	I, II, III and IV semester
B.Tech III year I semester	I, II, IIII, IV and V semester
B.Tech III year II semester	I, II, IIII, IV, V and VI semester
B.Tech IV year I semester	I, II, IIII, IV, V, VI and VII semester

Two Mid tests, Two mid Viva voce, one External Comprehensive Test and one External Comprehensive Viva Voce.

Allocation of marks :

*Comprehensive Test	: 70 marks
**Viva Voce	: 30 marks
Total	**: 100 marks**

*Average of two best Mid Tests of Mid Test – I, Mid Test – II and Mid Test - III will be taken for 30 marks.

Total marks for Comprehensive Test will be 70.

The total sessional marks in this subject of Comprehensive Test and Viva Voce will be : 30 for sessionals and 70 for End Semester examination.

The grand total of marks for the subject of Comprehensive Test and Viva Voce will be 100. The student has to secure 40% of marks i.e. 40 marks in sum total of 100 marks to be successful in the subject.

8.8 The laboratory records and internal test papers shall be preserved in the respective departments as per the college norms and shall be produced to the Committee of the college or any external agency like AICTE, NAAC, JNTUH, NBA etc., as and when the same are called for.

8.9. There shall be aInternship 1 and Internship 2, in an Industry of their specialization. Students will register for this immediately after II year II semester end examinationand III year II semester examinations and pursue it during summer vacation. Internship 1 and Internship 2 shall be submitted as a project report and presented before the committee in III year I semester andIV year I semester along with lab examination. This project report will be evaluated for 30 internal marks and 70 external marks. The committee consists of an external examiner, Head of the Department, Supervisor of the Internship project and Senior Faculty Member of the Department.

8.10 The laboratory marks and the internal marks awarded by the college are subject to scrutiny and scaled down by the Departmental committees wherever necessary. In such cases, the internal and laboratory marks awarded by the department will be referred to a committee. The committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendation of the committee is final and binding. The laboratory records and internal test papers shall be preserved in the respective departments as per the college rules and produced before the visiting committees as and when they are asked for.

8.11. For mandatory courses like orientation course, cyber security, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in sum total of continuous internal evaluation and external examination for passing the subject / course. These marks will be gradedas per table given in 3.2.2.

9.0 Grading procedure

9.1 Marks will be awarded to indicate the performance of student in each theory subject, laboratory / practicals, seminar, Group Project 1,2,3, in the Major project and Comprehensive Test and Viva.

Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

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

%of Marks Secured ina Subject / Course (Class Intervals)	**LetterGrade (UGCGuidelines)**	**GradePoints (GP)**
Greater thanorequalto90%	O (Outstanding)	10
80%and lessthan 90%	A+ (Excellent)	9
70%and lessthan 80%	A (VeryGood)	8
60%and lessthan 70%	B+ (Good)	7
50%and lessthan 60%	B (Average)	6
40%and lessthan 50%	C (Pass)	5
Below40%	F (FAIL)	0
Absent	Ab	0

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

9.4 A student who has not appeared for examination in any subject, '**Ab'** grade will be allocated in that subject, and student shall be considered '**failed'**. Student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered.

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

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

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

9.7 The student passes the subject / course only when **GP is not less than 5 (i.e. 'C' grade or above)**

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

SGPA = { $\sum_{i=1}^{N}$ $C_i G_i$ } / { $\sum_{i=1}^{N}$ C_i } …. For each semester

(i.e., upto and inclusive of S semesters, S 2),

where '**N'** is the **total** number of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered'** i.e., from the 1st semester onwards upto and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account the subjects from 1 to 8 semesters), C_J is the number of credits allotted to the Jth

subjects and G_j represents the grade points (GP) corresponding to the letter grade awarded for that Jth subject.

After registration and completion of the first year first semester, SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA

Course / Subject	Credits	Letter Grade	Grade Points	Credit Points
Course1	4	A	8	4x8 =32
Course2	4	O	10	4x10=40
Course3	4	C	5	4x5 =20
Course4	3	B	6	3x6 =18
Course5	3	A+	9	3x9 =27
Course6	3	C	5	3x5 =15
	21			152

SGPA = 152/21 = 7.24

Illustration of calculation of CGPA:

Course / Subject	Credits	Letter Grade	Grade Points	Credit points Points
I				
Course1	4	A	8	4x8 =32
Course2	4	A	9	4x9 =36
Course3	4	B	6	4x6 =24
Course4	3	O	10	3x10=30
Course5	3	B	7	3x7 =21
Course6	3	A	8	3x8 =24
I				
Course7	4	B	7	4x7 =28
Course8	4	O	10	4x10=40
Course9	4	A	8	4x8 =32
Course10	3	B	6	3x6 =18
Course11	3	C	5	3x5 =15
Course12	3	A	9	3x9 =27
Total Credits	= 42			Total Credit Points=327

CGPA = 327/42 = 7.79

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

9.10 For calculations listed in regulations 9.6 to 9.9, performance in failed subjects/ courses (securing **F** grade) will also be taken into account, and the credits of such subjects/courses will also be included in the multiplications and summations.

After passing the failed subject(s) newly secured letter grades will be taken into account for calculation of SGPA and CGPA.

However, mandatory courses will not be taken into consideration.

10.0 Passing standards

10.1 A student shall be declared successful or 'passed' in a semester, if student secures a GP $\geq$ 5 ('C' grade or above) in every subject/course in that semester (i.e. when student gets SGPA 5.00 at the end of that particular semester); and a student shall be declared successful or 'passed' in the entire under graduate programme, only when gets a CGPA 5.00 for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, and grade earned etc.), credits earned, SGPA, and CGPA.

11.0 Declaration of results

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

11.2 For final percentage of formula may be used.

12.0 **Award of degree** marks equivalent to the computed final CGPA, the following
% of Marks = (final CGPA – 0.5) x 10

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

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

12.3 Students with final CGPA (at the end of the under graduate programme) 8.00 and above, and fulfilling the following conditions -

(i) Should have passed all the subjects/courses in '**first appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should have secured a CGPA $\geq$8.00, at the end of each of semesters, starting from first year first semester onwards.

(iii) Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason, shall be placed in **'FIRST CLASS WITH DISTINCTION'**, otherwise **FIRST CLASS** only.

12.4 Students with final CGPA (at the end of the under graduate programme) $\geq$ 6.5 but < 8.00, shall be placed in '**FIRST CLASS'**.

12.5 Students with final CGPA (at the end of the under graduate programme) $\geq$ 5.5 but < 6.5, shall be placed in '**SECOND CLASS'**.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the under graduate programme) ≥ 5 but <5.5, shall be placed in '**pass class**'.

12.7 A student with final CGPA (at the end of the under graduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**university rank**' and '**gold medal**'.

13.0 Withholding of results

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

14.0 Transitory regulations

14.1 A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the degree programme, may be considered eligible for readmission to the same subjects / courses (or equivalent subjects/ courses, as the case may be), and same professional electives / open electives (or from set/category of electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the date of commencement of student's first year first semester).

A student admitted in one academic regulation and he is getting readmission in some other academic regulations , the college has to offer substitute / additional subjects based on the comparison of two academic regulations. The details of substitute / additional subjects offered with the recommendations of board of studies of the concerned branch has to be given from time to time. The student will be governed by the academic regulations at the time of re-admission.

15.0 Student transfers

15.1There shall be no branch transfers after the completion of admission process.

15.2 The students seeking transfer to Sreenidhi Institute of Science and Technology (SNIST) from various other Universities / institutions have to pass the failed subjects which are equivalent to the subjects of SNIST, and also pass the subjects of SNIST which the students have not studied at the earlier institution.

Further, though the students have passed some of the subjects at the earlier semesters of SNIST, the students have to study substitute subjects in SNIST and get sessional marks by attending 3rd mid test and paying requisite fee as per the rules.

15.3 The transferred students from other Universities/ institutions to SNIST who are on rolls to be provided one chance to write the CIE (internal marks) in the failed subjects and /or subjects not studied as per the clearance letter issued by the Institution.

15.4 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the failed subjects and /or subjects not studied, to the students transferred from other universities / institutions to SNIST who are on rolls, as per the clearance (equivalence) letter issued by the University.

16.0 **Scope**

16.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

16.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final and binding.

16.3 The Institution may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the date notified by the Institution.

Academic Regulations for B.Tech.
(LATERAL ENTRY SCHEME)
w.e.f the AY 2021-22

1. Eligibility for award of B. Tech. Degree (LES)
The Lateral Entry Scheme (LES) students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years failing which he will forfeit the seat.

2. The student shall register and secure for all the credits with CGPA ≥ 5 from II year to IV year B.Tech. programme (LES) as per the regulations for the award of B.Tech. degree. **Out of the total credits secured, the student can avail exemption up to 6 credits**, that is, one open elective subject and one professional elective subject or two professional elective subjects for B.Tech programme to improve the performance of the Grade point average.

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.However, the student can take **two more** years for appearing the examinations.

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

5. <u>Promotion rules based on credits</u>

S.	Promotion	Conditionstobefulfilled
1	Second year first semester to second year second semester	Regularcourseofstudyofsecondyearfirst semester.
2	Secondyearsecondsemestertothird yearfirstsemester	(i)Regular course ofstudyofsecondyear secondsemester. (ii)Musthavesecuredatleast27credits outof45credits i.e.,60% ofcreditsup to second yearsecond semester fromall the relevant regular and supplementary examinations, whether thestudenttakes thoseexaminationsor not.
3	Thirdyearfirstsemestertothirdyear secondsemester	Regularcourseofstudyofthirdyearfirst semester.

4	Thirdyearsecondsemestertofourth yearfirstsemester	(i) Regularcourseof study ofthird year secondsemester. (ii)Musthavesecuredatleast52credits outof87credits i.e.,60% ofcreditsup to third year second semester from all the relevant regular and supplementary examinations, whether the student takes thoseexaminationsor not.
5	Fourth year first semester to fourth year secondsemester	Regularcourseofstudyoffourthyearfirst semester.

6. AlltheotherregulationsasapplicabletoB.Tech.4-yeardegreecourse(Regular) willholdgoodforB.Tech.(LateralEntryScheme).

MALPRACTICERULES
DISCIPLINARYACTIONFORMIS-CONDUCTOF STUDENTS DURING EXAMINATIONS

	Natureof Malpractice/ Mis-conduct of the conduct	**Punishment**
	If thestudent:	
1.(a)	Possesses or keeps accessible in examination hall,anypaper,notebook, programmable calculators,cellphones, pager, palm computers or any other form ofmaterialconcerned with or relatedtothesubject of theexamination (theory orpractical)inwhichstudentis appearing buthasnotmadeuseof (materialshallinclude any marks onthe bodyofthestudentwhichcanbeused asanaidinthe subject ofthe examination)	Expulsion fromtheexamination halland cancellationoftheperformance inthatsubject only.
(b)	Givesassistanceor guidanceorreceives itfromanyotherstudentorallyorby anyotherbody languagemethodsor communicates throughcellphoneswith any studentorpersons inoroutside the examhallinrespectofanymatter.	Expulsion fromtheexamination halland cancellationoftheperformance inthatsubject only ofallthestudentsinvolved. Incaseofan outsider, hewillbehanded overtothepolice andacaseisregisteredagainsthim.
2.	Has copiedintheexaminationhallfrom any paper,book,programmable calculators, palm computers or any other formofmaterialrelevant tothe subject ofthe examination(theoryor practical)inwhich thestudent is appearing.	Expulsion from the examination hall and cancellationoftheperformance inthatsubject andallother subjectsthestudenthasalready appearedincludingpracticalexaminations and UGmajorprojectandshallnotbepermitted to appearfortheremainingexaminations ofthe subjectsofthatsemester/year. Thehallticketofthestudent istobecancelled andsenttotheuniversity.
3.	Impersonates any other student in connectionwiththeexamination.	The student who has impersonated shall be expelledfromexamination hall. Thestudentis alsodebarred andforfeitstheseat.The performance oftheoriginalstudentwhohas beenimpersonated,shallbecancelledinallthe subjects ofthe examination (including practicalsandUGmajor project)already appeared andshallnotbeallowed toappearfor examinations oftheremainingsubjectsofthat semester/year. Thestudentisalsodebarred for twoconsecutivesemesters from classwork and alluniversityexaminations. Thecontinuation
		ofthecoursebythestudentissubjecttothe academicregulationsinconnection with forfeiture of seat. If theimposter is an outsider, hewillbehanded overtothepolice andacaseisregisteredagainsthim.

4.	Smuggles intheanswerbookor additional sheetor takesoutorarranges tosendoutthequestionpaperduring theexamination oranswerbookor additional sheet,during orafterthe examination.	Expulsion fromtheexamination halland cancellationofperformance inthatsubjectand alltheother subjects thestudenthasalready appearedincludingpracticalexaminations and UGmajorprojectandshallnotbepermitted fortheremainingexaminations ofthesubjects ofthatsemester/year. Thestudent isalso debarred fortwoconsecutive semestersfrom classworkand all universityexaminations.The continuationof thecoursebythe studentis subjecttotheacademicregulations in
5.	Usesobjectionable,abusiveoroffensive language inthe answer paper or in letterstotheexaminers orwritestothe examinerrequesting himtoawardpass marks.	Cancellationoftheperformanceinthatsubject.
6.	Refusestoobeytheordersofthechief superintendent/assistant – superintendent /anyofficeronduty or misbehaves or creates disturbance of any kind inandaroundtheexamination hallororganizesawalkoutorinstigates others towalkout, orthreatensthe officer-inchargeoranyperson onduty inoroutsidetheexaminationhallofany injuryto his personor to anyof his relationswhether bywords,either spoken orwrittenorbysignsorby visiblerepresentation, assaultsthe officer-in-charge,oranypersononduty inoroutsidetheexaminationhallorany ofhisrelations,orindulgesinany other actofmisconduct ormischiefwhich result in damage to or destructionof property intheexaminationhallorany part of the collegecampusor engagesin anyotheractwhichintheopinionof theofficeronduty amountstouseof unfairmeansormisconduct orhasthe	Incaseofstudentsofthecollege,they shallbe expelledfromexamination hallsand cancellation of their performance in that subjectandallothersubjectsthestudent(s) has (have)already appearedandshallnotbe permitted toappearfortheremaining examinations ofthesubjectsofthat semester/year. Thestudents alsoaredebarred andforfeittheirseats. Incaseofoutsiders, they willbehandedovertothepoliceanda policecaseisregisteredagainstthem.

7.	Leaves theexamhalltaking away answerscriptorintentionallytears of thescriptorany partthereofinsideor outsidetheexaminationhall.	Expulsion from the examination hall and cancellationofperformance inthatsubjectand alltheother subjects thestudenthasalready appearedincludingpracticalexaminations and UGmajorprojectandshallnotbepermitted fortheremainingexaminations ofthesubjects of thatsemester/year. Thestudent isalso debarred fortwoconsecutive semestersfrom classworkand all universityexaminations.The continuationof thecoursebythe studentis subjecttotheacademicregulations in

8.	Possessanylethalweaponorfirearmin theexaminationhall.	Expulsion from the examination hall and cancellationoftheperformance inthatsubject andallother subjects thestudenthasalready appearedincludingpracticalexaminations and UGmajorprojectandshallnotbepermitted fortheremainingexaminations ofthesubjects of thatsemester/year. Thestudent isalso debarredandforfeitsthe seat.
9.	Ifstudent ofthecollege,whoisnota studentforthe particular examinationor any personnotconnectedwiththe collegeindulges inanymalpracticeor improperconduct mentionedinclause6 to8.	Student of the colleges expulsion from the examination hallandcancellationofthe performance inthatsubjectandallother subjectsthestudenthasalready appeared includingpracticalexaminationsandUGmajor projectandshallnotbepermitted forthe remainingexaminations ofthesubjectsofthat semester/year. Thestudentisalsodebarred and forfeitstheseat. Person(s)whodonotbelongtothecollege will behandedover topoliceand,apolicecasewill
10.	Comesin adrunkenconditionto the examinationhall.	Expulsion from the examination hall and cancellationoftheperformance inthatsubject andallother subjects thestudenthasalready appearedincludingpracticalexaminations and UGmajorprojectandshallnotbepermitted fortheremainingexaminations ofthesubjects ofthatsemester/year.
11	Copying detected on the basis of internalevidence, suchas,during valuationorduringspecialscrutiny.	Cancellationoftheperformanceinthatsubject andallothersubjects thestudenthasappeared includingpracticalexaminationsandUGmajor projectofthatsemester/yearexaminations.

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

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.

2. Punishment for institutions: (if the squad reports that the college is encouraging malpractices)

   a. A show cause notice shall be issued to the college.
   b. Impose a suitable fine on the college.
   c. Shifting the examination centre from the college to another college for a specific period of not less than one year.

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I Year I Semester ECE

Sl. No	Course Type	Dept Course	Code	Name of the Course	L	T	P	C	CIE	SEE
1	BS	S&H	8HC04	Engineering Chemistry	4	0	0	4	30	70
2	ES	IT	8FC01	Problem Solving using C	3	0	0	3	30	70
3	BS	S&H	8HC09	Matrix Methods and Calculus	2	1	0	3	30	70
4	ES	S&H	8BC01	Workshop/Manufacturing Processes	1	0	0	1	30	70
5	HS	S&H	8HC01	Oral Communication Skills	1	0	0	1	30	70
6	BS	S&H	8HC08	Basic Mathematics, Analysis and Reasoning	2	1	0	3	30	70
7	BS	S&H	8HC64	Engineering Chemistry Lab	0	0	2	1	30	70
8	ES	IT	8FC61	Problem Solving using C Lab	0	0	2	1	30	70
9	ES	S&H	8BC61	Workshop/Manufacturing Processes Lab	0	0	2	1	30	70
10	HS	S&H	8HC61	Oral Communication Skills Lab	0	0	2	1	30	70
11	BS	ECE	8C160	Comprehensive Test and Viva Voce-I (2 Mids(Viva) and End Semester(Test and Viva) = 30+70)	1	0	0	1	30	70
12	BS	ECE	8C161	Technical Seminar – I	1	0	0	1	100	00
13	HS	S&H	8HC18	Orientation Course*	1	0	0	0	Marks and Grades will be given at the end of I – II Sem	
				Total	**16**	**2**	**8**	**21**	**430**	**770**

* a) Orientation Course for B. Tech I year I semester Students take place for 3 weeks durationcovering the first Two Units

b) Orientation Course for B. Tech I year II semester Students take place for covering theremaining Four Units (Units III, IV, V, and VI).

I Year II Semester ECE

Sl. No	Course Type	Dept Course	Code	Name of the Course	L	T	P	C	CIE	SEE
1	BS	S&H	8HC07	Engineering Physics	3	1	0	4	30	70
2	ES	CSE	8EC01	Data Structures and C++	3	0	0	3	30	70
3	BS	S&H	8HC11	Advanced Calculus and Complex Variable	3	1	0	4	30	70
4	ES	S&H	8BC02	Engineering Graphics	1	0	4	3	30	70
5	HS	S&H	8HC02	Written Communication Skills	1	0	0	1	30	70
6	ES	EEE	8AC42	Electrical Circuits & Networks Analysis	2	1	0	3	30	70
7	ES	EEE	8AC61	Electrical Circuits & Networks AnalysisLab	0	0	2	1	30	70
8	BS	S&H	8HC66	Engineering Physics Lab	0	0	2	1	30	70
9	ES	CSE	8EC61	Data Structures (C/C++) Lab	0	0	2	1	30	70
10	HS	S&H	8HC62	Written Communication Skills Lab	0	0	2	1	30	70
11	BS	ECE	8C262	Comprehensive Test and Viva Voce-II (2 Mids(Viva) and End Semester(Test and Viva) = 30+70)	1	0	0	1	30	70
12	BS	ECE	8C263	Technical Seminar – II	1	0	0	1	100	00
13	HS	S&H	8HC18	Orientation Course*	2	0	0	0	Grade evaluation	
									30	70
				Total	17	3	12	24	460	840

II Year I Semester ECE

Sl. No	Course Type	Dept Course	Code	Name of the Course	L	T	P	C	CIE	SEE
1	PC	ECE	8CC01	Electronic Devices and Circuits	3	0	0	3	30	70
2	PC	ECE	8CC02	Digital Logic Design	2	0	0	2	30	70
3	PC	ECE	8CC03	Signals and Systems	3	0	0	3	30	70
4	PC	ECE	8C304	Probability Theory and Stochastic Process	2	1	0	3	30	70
5	BS	S&H	8HC14	Transform Techniques and Numerical Methods	2	1	0	3	30	70
6	HS	S&H	8HC17	Universal Human Values	2	1	0	3	30	70
7	HS	S&H	8HC03	Soft Skills	1	0	2	2	30	70
8	PC	ECE	8CC71	Electronic Devices and Circuits Lab	0	0	2	1	30	70
9	PC	ECE	8CC72	Basic Simulation Lab	0	0	2	1	30	70
10	PC	ECE	8CC73	Digital Logic Design Lab	0	0	2	1	30	70
11	PW	ECE	8C364	Comprehensive Test and Viva Voce-III (2 Mids(Viva) and End Semester(Test and Viva) = 30+70)	1	0	0	1	30	70
12	PW	ECE	8C365	Technical Seminar - III	1	0	0	1	100	00
				Total	17	3	8	24	430	770

II Year II Semester ECE

Sl. No	Course Type	Dept Course	Code	Name of the Course	L	T	P	C	CIE	SEE
1	PC	ECE	8CC05	Analog Circuits	2	0	0	2	30	70
2	PC	ECE	8CC06	Analog& Digital Communications	2	1	0	3	30	70
3	PC	ECE	8CC07	IC Applications	2	0	0	2	30	70
4	PC	ECE	8C408	Electromagnetic Waves and Transmission Lines	3	0	0	3	30	70
5	HS	MBA	8ZC01	Economics, Accountancy and Management Science	2	0	0	2	30	70
6	ES	IT	8FC27	Python Programming Concepts	2	0	0	2	30	70
7	HS	S&H	8HC05	Environmental Science and Ecology	2	0	0	2	30	70
8	PC	ECE	8CC74	Analog Circuits Lab	0	0	2	1	30	70
9	PC	ECE	8CC75	Analog& Digital Communication Lab	0	0	2	1	30	70
10	PC	ECE	8CC76	IC Applications Lab	0	0	2	1	30	70
12	PW	ECE	8C466	Comprehensive Test and Viva Voce-IV (2 Mids(Viva) and End Semester(Test and Viva) = 30+70)	1	0	0	1	30	70
13	PW	ECE	8C467	Technical Seminar - IV	1	0	0	1	100	00
14	PW	ECE		Summer Industry Internship - I: Evaluation will be done along with 3-1 courses						
				Total	17	1	6	21	430	770

III Year I Semester ECE

Sl. No	Course Type	Dept Course	Code	Name of the Course	L	T	P	C	CIE	SEE
1	PC	ECE	8CC09	Digital Signal Processing	2	1	0	3	30	70
2	PC	ECE	8C510	VLSI Technology and Design	3	0	0	3	30	70
3	PC	ECM	8DC05	Microprocessors and Microcontrollers	3	0	0	3	30	70
4	PC	ECE	8C511	Cellular and Mobile Communication	2	0	0	2	30	70
5	PC	ECE	8C512	Antennas and Wave Propagations	2	1	0	3	30	70
6	PE	ECE		Professional Elective- I	3	0	0	3	30	70
7	PC	ECM	8DC71	Microprocessors and Microcontrollers Lab	0	0	2	1	30	70
8	PC	ECE	8C577	VLSI Technology and Design Lab	0	0	4	2	30	70
9	ES	IT	8FC72	Python Programming Lab	0	0	4	2	30	70
10	PW	ECE	8C591	Summer Industry Internship-I	0	0	1	1	30	70
11	MC	IT	8FC24	Cyber Security	2	0	0	0	Grade evaluation	
									30	70
				Total	16	2	11	23	330	770

III Year II Semester ECE

Sl. No	Course Type	Dept Course	Code	Name of the Course	L	T	P	C	CIE	SEE
1	PC	CSE	8EC47	Computer Networks	2	0	0	2	30	70
2	PC	ECE	8C613	Microwave and Optical Communications	3	0	0	3	30	70
3	MC	CSE	8EC45	Artificial Intelligence	2	0	0	0	Grade evaluation	
									30	70
4	ES	EEE	8AC07	Linear Control systems	3	0	0	3	30	70
5	PE	ECE		Professional Elective- II	3	0	0	3	30	70
6	OE			Open Elective- I	2	0	0	2	30	70
7	PC	ECE	8C678	Antenna Simulation Lab	0	0	4	1	30	70
8	PC	CSE	8EC65	Computer Networks Lab	0	0	2	1	30	70
9	PC	ECE	8CC79	Digital Signal Processing Lab	0	0	4	2	30	70
10	PW	ECE	8C692	Group Project	0	0	2	1	30	70
11	PW	ECE	8C668	Comprehensive Viva Voce	1	0	0	1	30	70
12	PW	ECE		Summer Industry Internship - II: Evaluation will be done along with 4-1 courses						
				Total	16	0	12	19	330	770

IV Year I Semester ECE

Sl. No	Course Type	Dept Course	Code	Name of the Course	L	T	P	C	CIE	SEE
1	PC	ECE	8C714	Internet of Things and Applications	2	1	0	3	30	70
2	PC	ECE	8C715	Advanced Communications and Networks	3	1	0	3	30	70
3	HS	ECE	8C716	Intellectual Property Rights	1	0	0	1	30	70
4	PE	ECE		Professional Elective –III	3	0	0	3	30	70
5	PE	ECE		Professional Elective – IV	3	0	0	3	30	70
6	OE			Open Elective – II	2	0	0	2	30	70
7	PC	ECE	8C780	Internet of Things and Applications Lab	0	0	4	2	30	70
8	PC	ECE	8C781	Advanced Communications and Networks Lab	0	0	4	2	30	70
9	PC	ECE	8C782	Microwave and Optical Communications Lab	0	0	4	2	30	70
10	PW	ECE	8C793	Summer Industry Internship - II	0	0	1	1	30	70
				TOTAL	**14**	**2**	**13**	**22**	**300**	**700**

IV Year II Semester ECE

Sl. No	Course Type	Dept Course	Code	Name of the Course	L	T	P	C	CIE	SEE
1	PE	ECE		Professional Elective –V	3	0	0	3	30	70
2	OE			Open Elective – III	2	0	0	2	30	70
3	PW	ECE	8C894	Major Project	0	0	10	5	30	70
				TOTAL	**5**	**0**	**10**	**10**	**90**	**210**

Professional Electives

S. No	Stream	PE-I	PE- II	PE-III	PE-IV	PE-V
1	**Code**	**8C517**	**8C623**	**8C729**	**8C735**	**8C841**
	VLSI	Digital Design Through Verilog	Analog and Mixed Signal Design	VLSI Physical Design	Design Verification using System Verilog	Low Power VLSI Design
2	**Code**	**8CC18**	**8CC24**	**8C730**	**8C736**	**8C842**
	Embedded System	Advanced Computer Architecture	Embedded C Programming	Embedded System Design using ARM	Embedded Real Time Operating Systems	SystemonChip Architecture
3	**Code**	**8C519**	**8C625**	**8C731**	**8C737**	**8C843**
	Signal Processing	Digital Image & Video Processing	Transform Techniques	DSP Processors and Architectures	Bio-Medical Signal Processing	Radar Signal Processing
4	**Code**	**8C520**	**8C626**	**8C732**	**8C738**	**8C844**
	Communications	Information Theory and Coding Techniques	Software Defined Radio	Ad hoc and Wireless Sensor Networks	MIMO OFDM System	5G Communications
5		**8C521**	**8C627**	**8C733**	**8C739**	**8C845**
	Advanced Computing	Digital ImageProcessing	Artificial Neural Networks	Computer Vision	Machine Learning	Deep Learning
6		**8C522**	**8C628**	**8C734**	**8C740**	**8C846**
	Microwave and Radar	Phased Array Antennas	Satellite Communications	Radar Systems	Microwave Integrated Circuits	EMI/EMC

Open Electives

Sl. No	Stream	OE-I	OE-II	OE-III
1	**Code**	**8ZC05**	**8ZC19**	**8ZC15**
	Finance	Banking Operations, Insurance and Risk Management	Entrepreneurship, Project Management and Structured Finance	Financial Institutions , Markets and services
2	**Code**	**8EC72**	**8EC74**	**8EC76**
	Computer Science	Programming in Java	Database Systems Concepts	Operating Systems Concepts
	Code	**8ZC22**	**8ZC23**	**8ZC24**
3	Entrepreneurship	Basics of Entrepreneurship	Advanced Entrepreneurship	Product and Services
	Code	**8ZC25**	**8ZC26**	**8ZC27**
4	Social Sciences Stream	Basics of Indian Economy	Basics of Polity	Indian History, Culture and Geography
5	**Code**	**8CC51**	**8CC52**	**8CC53**
	ECE Stream	Electronics and Instrumentation	Fundamentals of Communication	Embedded Systems Concepts
		8CC56		
		Fundamentals of digital circuits & Microprocessors		
6	**Code**	**8AC47**	**8AC44**	**8AC45**
	EEE stream	Power Electronic Devices and Converters	Fundamentals of Measurements and Instrumentation	Fundamentals of Renewable energy sources
7	**Code**	**8BC51**	**8BC52**	**8BC53**
	Mechanical Stream	Introduction To Additive Manufacturing Processes	Principles of Operations Research	Principles of Automation and Robotics
8	**Code**	**8ZC08**	**8ZC09**	**8ZC10**
	Innovation and Design Thinking	Design literacy and Design Thinking	Co-Creation and Product Design	Entrepreneurship & Business Design

A20 - Total Credits
(Semester-wise Credit Distribution)

SL. NO	SEMESTER	CREDITS
1.	I-I	21
2	I-II	24
3	II-I	24
4.	II-II	21
5	III-I	22
6	III-II	20
7	IV-I	22
8	IV-II	10
	Total	**164**

Service Coursesoffered by ECE

Sl. No	Code	Name of Subject	Offered to Dept
1	8CC01	Electronic Devices and Circuits	ECM, EEE
2	8CC02	Digital Logic Design	ECM, EEE
3	8CC03	Signals and Systems	ECM, EEE
4	8CC71	Electronic Devices and Circuits Lab	ECM, EEE
5	8CC72	Basic Simulation Lab	ECM
6	8CC73	Digital Logic Design Lab	ECM
7	8CC05	Analog Circuits	ECM, EEE
8	8CC06	Analog& Digital Communications	ECM, EEE
9	8CC07	IC Applications	ECM, EEE
10	8CC74	Analog Circuits Lab	ECM, EEE
11	8CC75	Analog& Digital Communication Lab	ECM
12	8CC76	IC Applications Lab	ECM, EEE
13	8CC09	Digital Signal Processing	ECM, EEE
14	8CC79	Digital Signal Processing Lab	ECM
15	8CC18	Advanced Computer Architecture	EEE
16	8CC24	Embedded C Programming	EEE
17	8CC54	Analog Electronic Circuits	CSE, IT
18	8CC83	Analog Electronic Circuits Lab	CSE, IT
19	8CC55	Digital Electronics	CSE, IT

III – I

Year/Sem	Sub. Code	Subject Name	L	T	P/D	C
III-I	8CC09	Digital Signal Processing	2	1	0	3

Course objectives: To develop skills for analyzing and synthesizing algorithms and systems that process discrete time signals, with emphasis on realization and implementation.

Course outcomes*:*

1. *Distinguish between CT and DT signals and systems and understand the growing need of DSP and study the concepts of discrete time signals and systems.*
2. *Represent periodic DT signals as a Fourier series; non-periodic DT signals as a Fourier Transform and use a powerful mathematical tool called DFT.*
3. *Compute the Fourier Transform of DT signals using the FFT algorithms.*
4. *Realize a digital IIR filter in several forms and structures for a given transfer function H(z)and can design IIR filter as per specifications .*
5. *Design of digital FIR filters by several methods as per the given specifications and can realize FIR Filter*
6. *Understand the need and implement the multirate sampling techniques.*

Mapping of Course Outcomes with Program Outcomes

CO	**Digital Signal Processing (8CC09)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Distinguish between CT and DT signals and systems and understand the growing need of DSP and study the concepts of discrete time signals and systems.	2	2	1									3	2	2	
CO2	Represent periodic DT signals as a Fourier series; non-periodic DT signals as a Fourier Transform and use a powerful mathematical tool called DFT	2	2	2		1							3	2	3	
CO3	Compute the Fourier Transform of DT signals using the FFT algorithms.	3	2	2	2	3							3	2	3	
CO4	Realize a digital filter in several forms and structures for a given transfer function H(z).		2	2	2	3							3	2	3	
CO5	Distinguish IIR and FIR filters; Design each type by several methods once the desired specifications are given.		2	3	2	3							3	2	3	
CO6	Understand the need and implement the multirate sampling techniques.		2	2	2	3							3	2	3	
CO	Overall	2	2	2	2	3							3	2	3	

UNIT I : INTRODUCTION:

Introduction to Digital Signal Processing: Discrete time signals & sequences, Periodicity, linear shift invariant systems, stability, and causality, Linear constant coefficient difference equations, Block diagram representation of linear constant-coefficient difference equations,Frequency domain representation of discrete time signals and systems.

Applications: Contents form the foundation for DSP.

UNIT II : DISCRETE FOURIER TRANSFORM:

Discrete Fourier series representation of periodic sequences, Discrete-Time Fourier Transform(DTFT), Discrete Fourier transform (DFT): Properties of DFT, Relation between Z-transform and DFT, Convolution: Linear and circular convolutions, Overlap add and Overlap save methods, Computation of DFT.

Applications: Analysis of DT signals-Periodic and Aperiodic.

UNIT III : FAST FOURIER TRANSFORMS:

Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

Applications: Design of spectrally efficient system such as OFDM system.

UNIT IV: DIGITALIIR FILTERS:

ANALOG FILTER APPROXIMATIONS – Butterworth and Chebyshev Approximations.

IIR DIGITAL FILTERS: Design of IIR Digital filters from analog filters-Impulse Invariance, Step invariance and Bilinear Transformation methods, Design Examples, Analog-Digital transformations.Basic structures of IIR systems, Transposed forms,

Applications: Design of IIR digital filter conforming to given specifications.

UNITV: DIGITALFIR FILTERS:

FIR DIGITAL FILTERS:Characteristics of FIR Digital Filters, frequency response, Design of FIR Digital Filters using Fourier series method, Windowing Techniques-Rectangular, Triangular, Hamming, Hanning and Bartlett's Windows, Steps in Kaiser windowing method, Frequency Sampling technique, Comparison of IIR and FIR filters.Basic structures of FIR systems

Applications: Design of FIR digital filter conforming to given specifications.

UNIT VI: MULTIRATE DIGITAL SIGNAL PROCESSING:

Decimation, interpolation, sampling rate conversion. Introduction to DSP Processors.

Applications of Multirate Digital Signal processing: Design of digital filter banks and quadrature mirror filters etc.

TEXT BOOKS:

1. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006
2. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
3. Digital Signal Processing: A Modern Introduction, Ashok Ambardar, 9th Indian Reprint, 2012, Cengage Learning.

REFERENCE BOOKS:

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.

3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using MatLab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
5. Discrete Time Signal Processing – A.V.Oppenheim

Year/Sem	Sub. Code	Subject Name	L	T	P/D	C
III-I	8C510	VLSI Technology and Design	3	0	0	3

Prerequisites:*EDC,STLD, LDICA*

Course Objectives*:*

The objectives of this course is to provide the students an in-depth knowledge on various aspects of VLSI circuits and their design including testing.

Course Outcomes*: After studying this course, the students will be able to*

CO1	*Understand the existing device technologies and IC fabrication process*
CO2	*Explore and analyze the electrical properties of the devices of CMMOS device.*
CO3	*Design basic logic gates, combinational and sequential circuits using CMOS logic.*
CO4	*Analyze the effects of parasitic on IC power and performance.*
CO5	*Design memory cells and basic data path units.*
CO6	*Explore the need for testing and design verification of VLSI circuits.*

Mapping of Course Outcomes with Program Outcomes

CO	**VLSI Technology and Design (8C510)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Understand the existing device technologies and IC fabrication process		3		3	2		2					2	3	2	
CO2	Explore and analyze the electrical properties of the devices of CMOS device.		2	2		2		2						2	1	
CO3	Design basic logic gates, combinational and sequential circuits using CMOS logic.			2	1	3		2						2	3	
CO4	Analyze the effects of parasitic on IC power and performance.		3	3		2		2					2	2	3	3
CO5	Design memory cells and basic data path units.		3	3	2	2		2					2	1	3	2
CO6	Explore the need for testing and design		3		2	2		2					2	1	3	

	verification of VLSI circuits.															
CO	Overall		3	3	2	2		2					2	2	3	3

Syllabus Content

UNIT I

INTRODUCTION TO MOS TECHNOLOGIES: MOS, PMOS, NMOS, CMOS &BiCMOS

INTRODUCTION TO IC TECHNOLOGY AND FABRICATION PROCESS: VLSI Design Flow, Oxidation, Lithography, Diffusion, Ion Implantation, Metallisation, Encapsulation, Probe testing, Integrated Resistors and Capacitors [T1-CH1, 2 & 3].

Application – CMOS IC Manufacturing

UNIT II

BASIC ELECTRICAL PROPERTIES: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of Merit (ω_o), Zpu/Zpd, Latch-Up in CMOS, Pass Transistors [T1-CH2]

INVERTERS: NMOS Inverter, Various Pull-Ups, CMOS Inverter Analysis and Design, Bi-CMOS Inverters [T1-CH2]

UNIT III

CIRCUIT DESIGN PROCESSES: MOS Layers, Stick Diagrams, Lamda-based CMOS Design rules for Wires, Contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling. [T1-CH3]

GATES: CMOS Logic Gates and Structures, Switch logic, Layout Diagrams Gates [T1-CH5]

Application – IC Physical Design – NAND and NOR

UNIT IV

DELAYS: Sheet Resistance R_s and its concept to MOS, Area Capacitance Units, Calculations - C_g, τ-Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out [T1- CH 4 & 5, T2-CH4]

Semiconductor Integrated circuit Design: PLD's, Introduction to CPLD's and FPGA's.

UNIT V

MEMORY AND SUBSYSTEM DESIGN: Latches and Registers [T2-CH7]**,** Clocking strategies (Single Phase) [T1-CH5.5],Memory cells (SRAM & DRAM), Adders, Shifter, Multipliers and ALUs [T1- CH8]

Applications – SRAM Based FPGAs and Multiply and Accumulate (MAC) Units

UNIT VI

INTRODUCTION TO CMOS TESTING: CMOS Testing, Need for testing, Test Principles, Design Strategies for Test, Chip level Test Techniques, System-level Test Techniques [T1-CH7]

Applications – Implementation of basic ATPG

TEXTBOOKS:

1. Basic VLSI Design –Douglas A. Pucknell, Kamran Eshraghian, PHI, 3rd Edition,2005.
2. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, Second Edition, 2009.

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REFERENCES:

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning.
2. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.
3. Digital Integrated Circuits: A Design Perspective - John M. Rabaey, 2/E, 2002
4. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
5. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8DC05**	**Microprocessors and Microcontrollers**	**2**	**0**	**0**	**2**

Course objectives: To develop skills for programming and interfacing using 8086 Microprocessor and 8051 Microcontroller.

Course outcomes*:*

1. *Understand Architecture of 8086 and analyzing in single mode and in multi processor mode.*
2. *Understand instructions of 8086 and to write Assembly Language Programs*
3. *Interface I/0 devices with 8086*
4. *Understand Architecture of 8051 microcontroller.*
5. *Understand instructions of 8051 and to Interface I/0 devices with 8051*
6. *Understand the need advanced processors.*

CO	**Microprocessors, and Microcontrollers (8DC05)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Understands the Architecture of 8086.	3	2	2	1	1							3	3	1	
C02	*Understand instructions of 8086 and to write Assembly Language Programs*	1	3	3	2								2	2	3	
CO3	*Interface I/0 devices with 8086*	1	2	3	3	3	3						2	3	3	
CO4	*Understand Architecture of 8051 microcontroller*	3	2	2	1	1							3	3	1	
CO5	*Understand instructions of 8051 and to Interface I/0 devices with 8051*	1	2	3	3								2	1	2	
C06	*Understand the need of advanced*	2		3	3	3	3						2	2	3	

	processors															
CO	Overall	2	2	3	2	2	3						2	2	2	

UNIT - I

Architecture of 8086 Microprocessor: Memory segmentation, BIU and E.U General purpose registers. 8086 flag register and function of 8086 Flags. Pin diagram of 8086-Minimum mode and maximum mode of operation. Timing Diagram.

UNIT – II

Instruction set of 8086: Addressing modes of 8086. Assembly directives. Simple programs, procedures, and macros. Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation. Introduction to DOS and BIOS interrupts.

Applications: Design of an 8-bit Calculator

UNIT - III

Interfacing with 8086: Interfacing with RAMs, ROMs along with the explanation of timing diagrams. 8255 PPI – various modes of operation. Interfacing with key boards, ADCs, and DACs Stepper Motor .Interrupt structure of 8086. Vector interrupt table. Interrupt service routines. 8259 PIC Architecture and interfacing cascading of interrupt controller and its importance.

Applications: Interfacing of a Temperature sensor with 8086

UNIT - IV

The 8051 Architecture: Architecture of 8051 Micro controller, Memory Organization. Special Function Registers. Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

UNIT – V

Instruction set of 8051: Programming the 8051, Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Simple programs. Programs based on SFRs on Timers ,Interrupts.

Applications of 8051: Interfacing 7 segment LEDs, LCDs, Interfacing with ADCs. Interfacing with DACs.

UNIT – VI

Introduction to ARM Processors: Harvard and Von Neumann architectures, CISC & RISC Architecture CPU Registers, CPU Operating Modes, The ARM 7 TDMI architecture-ARM organization and implementation-The ARM instruction set-The Thumb instruction set-Basic ARM assembly language programs

TEXT BOOKS :

1. Advanced microprocessor & Peripherals - A.K.Ray&K.M.Bhurchandi, TMH, 2000.
2. Microprocessors and interfacing – Douglas V. Hall, TMH, 2nd Edition, 1999.
3. 8051 Microcontroller–Kenneth J. Ayala, Penram International/ Thomson, 3rd Edition, 2005.
4. The 8051 Microcontroller And Embedded Systems Using Assembly And C – Mazidi, Pearson Education India,2nd edition, 2008. Jane W. S Liu, " Real Time Systems" Pearson Higher Education ,3rd Edition, 2000.
5. Steve Furber, ARM System on-chip Architecture, Addison Wesley

REFERENCES :

1. Micro computer systems, The 8086/8088 Family Architecture, Programming and Design – Y.Liu and G.A. Gibson, PHI, 2nd Edition.
2. 8051 Micro Controllers and Embedded Systems – Dr. Rajiv Kapadia, Jaico Publishers.

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C511**	**Cellular and Mobile Communication**	**3**	**0**	**0**	**3**

Prerequisites: Analog & Digital Communications

Course Objectives:

The objectives of this course are

- Be acquainted with the role of cellular and mobile communications in frequency management issues.
- Be acquainted with different interference factors influencing cellular and mobile communications.
- Be able to efficiently use the background behind developing different path loss and/or radio coverage in cellular environment

Course Outcomes: After studying this course, the students will be able to

CO1	Understand the working principle and limitations/advancements of conventional mobile telephone systems, cellular mobile systems and Advanced generations of cellular wireless systems
CO2	Analyze Frequency reuse concept and avoidance of Co-channel interference.
CO3	Explore the concepts of adjacent channel interference, its effects and avoidance mechanism.
CO4	Analyze signal reflections, path loss, propagation delay/loss, near and long distance propagation loss under different conditions, Merits of Lee model
CO5	Analyze frequency allocation of cellular systems
CO6	Demostrate the concept of handoff mechanism and dropped calls.

Mapping of Course Outcomes with Program Outcomes

CO	**Cellular and Mobile Communications (8C511)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*Understand limitations of conventional mobile telephone systems, basics of cellular mobile systems, generations of cellular wireless*	3	2	2	2			1						3		1

	systems.															
CO2	*Analyze Frequency reuse concept and avoidance of Co-channel interference .*		2	3	2	2	2							3	2	
CO3	*Explore the concepts of adjacent channel interference , its effects and avoidance mechanism*		2	3	2	3	2	2						2	2	2
CO4	*Analyze signal reflections, path loss, propagation delay/loss, near and long distance propagation loss under different conditions, Merits of Lee model*			2	2	2								2	1	1
CO5	*Analyze frequency allocation of cellular systems*		1	2	1	1								1	1	
CO6	*Demostrate the concept of handoff mechanism and dropped calls.*		1	2	1	2	1	1						3	1	1
CO	Overall	3	2	2	2	2	2	1						2	1	1

Syllabus Content

UNIT I

INTRODUCTION TO CELLULAR MOBILE RADIO SYSTEMS:

Limitations of conventional mobile telephone systems, Significance of 800MHz, Basic cellular wireless systems; 1G, 2G, 2.5G, 3G, 4G, 5G cellular wireless systems; Uniqueness of mobile radio environment – Long term fading, factors influencing short term fading, parameters of mobile multi path fading: time dispersion parameters, coherence bandwidth, Doppler spread and coherence time. Types of small scale fading. Diversity techniques – time, space, frequency.

UNIT-II
FUNDAMENTALS OF CELLULAR RADIO SYSTEM DESIGN:

Concept of Frequency reuse, Co-channel Interference, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni directional Antenna system, System capacity, Trunking and grade of service; Improving coverage and capacity in cellular system – cell splitting, sectoring, micro cell zone concept.

UNIT-III
CHANNEL INTERFERENCE:

Measurement of real time Co-Channel Interference, Design of antenna system, Antenna parameters and their effects; Diversity techniques- Space diversity, polarization diversity, Frequency diversity and Time Diversity. Non-co-channel interference-Adjacent channel Interference, near end and far end interference, cross talk, effect on coverage and Interference by power decrease, antenna height decrease, effect of cell site components, UHF TV interference

Applications: Design of a cellular systems using frequency reuse factor (k=19) for directional and Omni-directional antenna systems

UNIT-IV
CELL COVERAGE FOR SIGNAL AND TRAFFIC :

Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation, path loss from a point to point prediction model in different conditions, merits-of-LEE-model.

UNIT-V
FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:

Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.
HANDOFF, DROPPED CALLS:

Handoff initiation, types of Handoff, delayed handoff, Advantages of handoffs, Power difference handoff, forced handoff, mobile assigned handoff and soft handoff, Intersystem handoff. Introduction to dropped call rates and their evaluation.

UNIT-VI

DIGITAL CELLULAR NETWORKS: GSM architecture, GSM channels, multiple access scheme, TDMA, FDMA, CDMA,WCDMA, SDMA, OFDM.

TEXTBOOKS :

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006.
2. Principles of Mobile Communications – Gordon L. Stuber, Springer International 2nd Edition, 2007.

REFERENCES:

1. Wireless Communications - Theodore. S. Rapport, Pearson education, 2nd Edn., 2002.
2. Wireless and Mobile Communications – Lee McGraw Hills, 3rd Edition, 2006.
3. Wireless Communication and Networking – Jon W. Mark and WeihuaZhqung, PHI, 2005.
4. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C512**	**Antennas and Wave Propagations**	**2**	**1**	**0**	**3**

Prerequisites: *EMTL*

Course Objectives:

The objectives of this course are

- *To study and learn various antennas, their working principle, arrays and radiation patterns of antennas.*
- *To understand various techniques involved in various antenna parameter measurements.*
- *To understand the radio wave propagation in the atmosphere*

Course Objectives*: After studying this course, the students will be able to*

CO1	*Learning the radiation mechanism of antenna and antenna parameters*
CO2	*Design and analyze wire antennas and antenna arrays*
CO3	*Evaluate knowledge on Horn, Parabolic and Lens antennas.*
CO4	*Analysis of Horizontal Polarized antennas, Helical antennas , Patch antennas etc.*
CO5	*Understand the propagation mechanisms of ground wave, sky wave and space wave concepts.*
CO6	*Analysetheconcepts of sky wave propagation .*

Mapping of Course Outcomes with Program Outcomes

CO	**Antennas and Wave Propagation (8C512)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Explain electromagnetics and antenna characteristics	3												3		
CO2	Explain wire antennas and antenna arrays		2	3										2	2	
CO3	Evaluate knowledge on Horn, Parabolic and Lens antennas		2	3			1						2		2	
CO4	Recall knowledge on Horizontal Polarized antennas, Helical antennas , Patch antennas etc		2	3			1						1	1		
CO5	Discuss ground wave and space wave propagation and space	2	2				1						2	3		

	wave concepts															
CO6	Analyse concepts of sky wave propagation		3	3			1						2	2		
CO	Overall	3	2	3			1						2	2	2	

Syllabus Content

Unit-I:

FUNDAMENTAL PARAMETERS OF ANTENNAS

Review of Electromagnetic Theory: Vector Potential, Solution of Wave Equation, Retarded Case, Hertizian Dipole. Antenna Characteristics: Radiation Pattern, Beam Solid Angle, Directivity, Gain, Input Impedance, Polarization, Bandwidth, Reciprocity, Equivalence of Radiation Patterns, Equivalence of Impedances, Effective Aperture, Vector Effective Length, Antenna efficiency.

Unit-II:

LINEAR WIRE ANTENNAS AND ARRAYS

Wire Antennas: Short Dipole, Radiation Resistance and Directivity, Half Wave Dipole, Monopole, Small Loop Antennas. Antenna Arrays: Linear Array and Pattern Multiplication, Two-Element Array, Uniform Array, BSA and EFA, EFA With increased Directivity. BSA with Non- uniform Amplitude Distributions and Binomial Arrays.

Unit-III:

APERTUREAND REFLECTOR ANTENNAS

Magnetic Current and its Fields, Uniqueness Theorem, Field Equivalence Principle, Duality Principle, Method Of Images, Pattern Properties, Slot Antenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat Reflector, Corner Reflector, Common Curved Reflector Shapes, Lens Antenna.

Applications: Design of parabolic reflector for DTH.

Unit-IV:

Long Wire, V and Rhombic Antenna, Yagi-Uda Antenna, Turnstile Antenna, Helical Antenna- Axial Mode Helix, Normal Mode Helix, Biconical Antenna, Log Periodic Dipole Array, Spiral Antenna, Microstrip Patch Antennas. Antenna Measurements: Radiation Pattern Measurement, Gain and Directivity.

Applications: Design of a 3-element Yagiguda Antenna for given specifications

Unit-V:

Surface Wave Propagation-Modes of Wave Propagation-Surface Wave Propagation and Surface Wave Tilt-Plane Earth Reflection, Reflection and Refraction of Waves-Field Strength due to Ground Wave-Multi-Hop Transmission. Tropospheric and Space Wave Propagation

UNIT VI:

Ionospheric Propagation: Structure of Ionosphere-Measures of Ionosphere Propagation-Critical Frequency-Angle of Incidence-MUF And LUF ,Optimum Working Frequency-Skip Distance, Virtual Height , Refractive Index of The Ionosphere, Effect of the Earth Magnetic Field and Fading

TEXT BOOKS -

1. John D. Kraus and Ronald J. Marhefka, *Antennas for All Applications* –TMH, 3rd Edn., 2003.
2. E.C. Jordan and K.G. Balmain ,*Electromagnetic Waves and Radiating Systems* –, PHI, 2nd ed., 2000. .

REFERENCES –

1. C.A. Balanis, *Antenna Theory* -John Wiley & Sons, 2nd ed., 2001.
2. K.D. Prasad, *Antennas and Wave Propagation* –, SatyaPrakashan, Tech India Publications, New Delhi, 2001.
3. E.V.D. Glazier and H.R.L. Lamont ,*Transmission and Propagation* –, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.
4. F.E. Terman*Electronic and Radio Engineering* –, McGraw-Hill, 4th edition, 1955.

John D. Kraus, *Antennas* – McGraw-Hill, 2nd ed, 1988.

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C517**	**Digital Design Through Verilog (PE-I)**	**3**	**0**	**0**	**3**

Prerequisites: *STLD, Programmaing concepts of any language*

Course Objectives:

The objectives of this course are

- *To introduce syntax, lexical conventions, data types and memory related to Verilog HDL.*
- *To design, test and implementation of thedigital hardware using various modeling styles.*
- *To design digital systems using FSM modeling.*

Course Outcomes*: After studying this course, the students will be able to*

CO1	*Understand levels of design description, concurrency, simulation and synthesis.*
CO2	*Apply language constructs, data types, operators available in verilog HDL.*
CO3	*Design combinational logic and sequential logic in gate level modeling.*
CO4	*Explain Gate and Switch level modeling.*
CO5	*Use system tasks, functions and UDPs.*
CO6	*Demonstrate SM charts and realize digital design using SM charts.*

CO	**Digital Design Through Verilog (8C517)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Understand levels of design description, concurrency, simulation and synthesis.			2									1	1		
CO2	Apply language constructs, data types, operators available in verilog HDL.		1			2								1	2	
CO3	Design combinationa l logic and sequential logic in gate level modeling.		1	3										2		
CO4	Explain Gate and Switch level modeling.		2	3	3	2								1	2	
CO5	Use system tasks, functions and UDPs.			1	2	3								2	3	

CO6	Demonstrate SM charts and realize digital design using SM charts.		3	3	3	1							1	3	1	
CO	Overall		2	2	3	2							1	2	2	

Syllabus Content

UNIT I

INTRODUCTION TO VERILOG HDL: Verilog HDL, Levels of Design Description, Concurrency, System Tasks, Simulation and Synthesis, Functional Verification.

LANGUAGE CONSTRUCTS AND CONVENTIONS: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators. Verilog Module structure, Test bench module- Net types, Strengths and Contention Resolution, Delays.

UNIT-II

MODELING AT DATA FLOW LEVEL: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

BEHAVIORAL MODELING: Introduction, Initial Construct, Always Construct, Assignments with delays, Blocking and Non blocking Assignments - Examples, Wait construct, Multiple Always Blocks, Design at Behavioral Level constructs- Case statements, i*f* and i*f*-else, repeat, for loop, while loop, forever loop. Other constructs- assign-deassign, disable, force-release.

UNIT-III

GATE LEVEL MODELING: Introduction, Gate Primitives- Illustrative Examples, Tri-State Gates, Design of Basic Circuits using Instantiation of Gate Primitives- Half, Full and Parallel Adders, Decoders, Multiplexers. Design of Flip-flops with Gate Primitives.

SWITCH LEVEL MODELING: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Trireg Nets-Examples.

UNIT-IV

SYSTEM TASKS, FUNCTIONS, AND COMPILER DIRECTIVES: Introduction, Parameters, Path Delays, Module Parameters, System Tasks and Functions, File-Based Tasks and Functions, Compiler Directives, Hierarchical Access, User- Defined Primitives (UDP).

UNIT-V

COMPONENT TEST AND VERIFICATION: Test bench – combinational circuit testing, sequential circuit testing, test bench techniques, design verification, assertion verification.

UNIT-VI

DIGITAL SYSTEM DESIGN AND VERIFICATION:FSM Design (Moore and Mealy Machines) – Vending Machine design and verification , Derivation and Realization of Algorithmic State Machine Chart Design and Verification examples - Binary Multiplier, Dice game. Other design examples - RAM (Single &DualPort), UART Design.

Text Books

1. T.R. Padmanabhan and B. Bala Tripura Sundari, Design through Verilog HDL – WSE, 2004 IEEE Press.
2. Charles H Roth, Digital Systems Design using VHDL , Jr. Thomson Publications, 2004.
3. Samir Palnitkar, Verilog HDL , 2nd Edition, Pearson Education, 2009

References

1. Sunggu Lee, Advanced Digital Logic Design using Verilog, State machines and Synthesis for FPGAs, - Cengage Learning
2. Stephen. Brown and ZvonkoVranesic, Fundamentals of Logic Design with Verilog, TMH, 2005.
3. J. Bhaskar, A Verilog Primier, BSP, 2003.
4. Michael D. Ciletti, Advanced Digital Design with Verilog HDL, PHI, 2005.
5. Sunggu Lee, Digital Logic Design using Verilog, State machine and synthesis for FPGA, Cengage Learning, 2009.

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8CC18**	**Advanced Computer Architecture (PE-I)**	**3**	**0**	**0**	**3**

Course Objectives:*Students will learn about*

1. *Various basic computer architectures, data representations and instruction sets.*
2. *Arithmetic unit, control unit and efficient computation using pipelining*
3. *Memory organization and optimization*
4. *I/O Communications and interfaces*

Course Outcomes: *After completing this course, student should be able to*

1. *To analyze the internal architecture of the computer*
2. *Understand the different data types and instruction set, of the computer*
3. *Understand the memory structure of the computer and learn CISC & RISC.*
4. *Understand processor structure and function and know the input output interfacings*

CO	Advanced Computer Architecture (8CC18)	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	*To analyze the internal architecture of the computer*	1	1											1		
CO2	*Understand the different data types and instruction set, of the computer*	2	2	2										2		
CO3	*Understand the memory structure of the computer and learn CISC & RISC*	2	2	2										2		
CO4	*Understand processor structure and function and know the input output interfacings*	2	2	2										2		
CO		2	2	2										2		

Unit – I

Introduction: Organization and Architecture, Structure and Function **–** Computer Evolution -Brief history of computers – Designing for performance.

Computer System: Components, Function – Interconnection Structures – Bus interconnection – PCI.

Unit – II

Instruction Set: Characteristics – Operand Types – Operation Types – Addressing Modes – Instruction formats

CPU: Computer Arithmetic operations: ALU – Integer Representation and Arithmetic – Floating Point Representation and Arithmetic.

Unit – III

Computer Memory System Overview - Cache Memory Principles - Elements of Cache Design
Internal Memory - Semiconductor Main Memory - Error Correction - Advanced Dram Organization
External Memory - Magnetic Disk – Raid

Unit – IV

Characteristics of CISC and RISC
Control unit: Micro–Operations – Control of Processors – Hardwired Implementation.
Micro Programmed Control: Basic concepts – Control Memory - Microinstruction Sequencing – Conditional branching – Mapping of instruction – Microinstruction Execution – Microprogram Example

Unit – V

Processor Structure and Function - Processor Organization - Register Organization - Instruction Cycle - Instruction Pipelining - Instruction Execution Characteristics - The Use of a Large Register File - Compiler-Based Register Optimization - Reduced Instruction Set Architecture - RISC Pipelining

Unit – VI

Input/Output - External Devices - I/O Modules - Programmed I/O - Interrupt - Driven I/O - Direct Memory Access - I/O Channels and Processors.

TEXT BOOKS:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Prentice Hall, 9th Edition, 2013
2. John P.Hayes, "Computer Architecture and Organization", Tata McGraw Hill, 3rd Edition, 2002.

REFERENCES:

1. Patterson, D. A., and Hennessy, J. L., "Computer Organization and Design: The Hardware/Software Interface", Morgan Kaufmann Publishers, 4th Edition, 2008.
2. D.A.GodseA.P.Godse, Computer Architecture & Organization, Technical Publications, 2007.
3. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization", Tata McGraw Hill, 5th Edition, 2002.
4. Morris Mano, " Computer Systems Architecture ", 3rd Edition, Pearson PHI Publication, 1993

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C519**	**Digital Image & Video Processing (PE-I)**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to:

1. Understand the image formation and its digital representation.
2. Learn representation of images in frequency domain and enhancement techniques.
3. Students would be able to solve the problems related to image compression and restoration.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Describe basic concepts of image processing system.
2. Summarize and compare various digital image transform techniques.
3. Demonstrate and survey digital image enhancement in practical applications.
4. Analyse the case study related to various techniques of image restoration.
5. Apply compression techniques on digital image.
6. Know the difference between analog video and digital video, different types of image formation and sampling of video signals.

CO	**DIGITAL IMAGE & VIDEO PROCESSING (8C519)**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	*Gets the knowledge of the basic step in image processing system, Discrete cosine transforms and discrete wave let transforms.*	3		2	3									2	2	3
CO2	*Differentiate image enhancement methods, different types of spatial domain and frequency domain methods..*	3	3	3	3	3								3	2	3
CO3	*Get the knowledge of point, line and edge detection, thresholding, Region based segmentation.*	3	3	3		2								3	3	3
CO4	*Differentiate different*	3	2	3	3	3								3	3	3

	types of redundancies, lossy and lossy less image compression, different types of coding techniques.															
CO5	*Know the difference between analog video and digital video, different types of image formation and sampling of video signals*	3	2			3								3	2	3
CO6	*Study the different types of motion estimation techniques and application of motion estimation in video coding.*	2		3	3	3								3	2	2
Overall PO mapping		2	3	2	3	3								3	3	3

UNIT-1: DIGITAL IMAGE FUNDAMENTALS&IMAGE TRANSFORMS

Elements of digital image processing systems, An image model, Basic relationships between pixels and basic transformation, Image acquisition, sampling and quantization, Image file formats, Two dimensional convolution, Two dimensional correlation, Two dimensional frequency responses.

UNIT-2: IMAGE ENHANCEMENT

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

UNIT-3: IMAGE RESTORATION

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter - Wiener filtering, Constrained least square restoration

UNIT-4: IMAGE SEGMENTATION AND RECOGNITION

Edge detection, Image segmentation: Region growing, Region splitting and merging, Edge linking, Morphological operations: Dilation, Erosion, Opening, Closing, Image recognition: Patterns and pattern classes, Matching by minimum distance classifier, Statistical classifier, Matching by correlation.

UNIT-5: IMAGE COMPRESSION

Need for image compression, Image coding, Huffman coding, Run length encoding, Arithmetic coding, Vector Quantization, Block truncation coding, Transform coding, Image compression standards

UNIT-6:

Basic steps of Video Processing

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals and filtering operations.

TEXT BOOKS:

1. Rafeel C Gonzalez, Richard E Woods, 'Digital Image Processing', Pearson education, Inc., second edition, 2004.
2. Anil K Jain, 'Fundamentals of Digital Image Processing', Prentice hall of India
3. William K Pratt, 'Digital Image Processing' , John Wiley, New York, 2002
4. Video processing and communication – Yao Wang, JoemOstermann and Ya–quin Zhang.1st Ed., PHI.

REFERENCES:

1. Lim JS, 'Two Dimensional Signal and Image Processing' , Prentice - hall New Jersey, 1990
2. Sid Ahmed M A, 'Image processing Theory, Algorithms and architectures', McGraw Hill, 1995
3. J T Tou and R.C. Gonzalez, 'pattern Recognition Principles', Addison Wesley publishing company
4. E. Gose and R. Johnson Bough, 'pattern Recognition and Image Analysis', Prentice hall of India
5. Digital Video Processing – M. Tekalp, Prentice Hall International

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C520**	**Information Theory and Coding Techniques(PE-I)**	**3**	**0**	**0**	**3**

Prerequisites: PTSP,DC,M-II

Course Objectives: After studying this course, the students will be able to

CO1	Explain different kind of networking models
CO2	Define different addressing schemes for networks.
CO3	Detailed idea of data link layer protocol and medium access protocol
CO4	Gain the knowledge of router configuration and network layer protocols and their working.
CO5	Differentiate the IPv4 and IPv6 addressing schemes for different networks.
CO6	Gain the knowledge of application layer protocols like DHCP, DNS.

CO	**Information Theory and Coding Techniques(PE-I) 8C520**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Explain different kind of networking models		3	3	3	3				2			3	3	3	
CO2	Define different addressing schemes for networks.		3	3	3	3				2			2	3	3	
CO3	Detailed idea of data link layer protocol and		3	3	3	3				2			2	3	3	

	medium access protocol.															
CO4	Gain the knowledge of router configuration and network layer protocols and their working.		3	3	3	3				2			2	3	3	
CO5	Differentiate the IPv4 and IPv6 addressing schemes for different networks.		3	3	3	3				2			2	3	3	3
CO6	Gain the knowledge of application layer protocols like DHCP, DNS.															
CO	overall		3	3	3	3				2			3	3	3	3

Syllabus Content

Unit – I

Information Theory: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

Unit – II

Source Coding: Encoding of the source output, Communication Channels, Discrete communication channels, Continuous channels, Shannon's encoding algorithm, Huffman Coding, Run-Length Encoding, Calculation of Coding efficiency and redundancy, Channel capacity for continuous channel and BSC.

Unit – III

Linear Block codes and cyclic codes

Introduction to Error Control Coding: Introduction, Types of errors, examples, Types of codes: Linear Block Codes: Matrix description, Error-Detecting and Error-correcting Capabilities of a Block code and Hamming codes.

Cyclic Codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes

Unit – IV

Convolution Codes: Encoding of Convolution Codes, Structural and Distance Properties, State diagram, Code tree diagram, Maximum-Likelihood decoding, Soft decision and hard decision decoding, the Viterbi algorithm.

Unit – V

Low Density Parity Check codes: Introduction, Matrix and Graphical representation, Galleger's method of construction, Regular and Irregular LDPC codes, other methods of constructing LDPC codes, Tanner graphs, Decoding of LDPC codes.

Unit – VI

Other coding techniques: BCH code, RS Code, Hamming Code, Golay Codes, Turbo codes- Definition, encoding and decoding process.

Text Books

1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley, 1996.
2. Digital communication, Simon Haykin, John Wiley, 2003.

Reference Books:

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007

Digital Communications - Glover and Grant; Pearson Ed. 2nd Ed 2008

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C521**	**Digital Image Processing (PE-I)**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to:

1. Understand the image formation and its digital representation.
2. Learn representation of images in frequency domain and enhancement techniques.
3. Students would be able to solve the problems related to image compression and restoration.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Describe basic concepts of image processing system.
2. Summarize and compare various digital image transform techniques.
3. Demonstrate and survey digital image enhancement in practical applications.
4. Analyse the case study related to various techniques of image restoration.
5. Apply compression techniques on digital image.

UNIT-1: DIGITAL IMAGE FUNDAMENTALS

Elements of digital image processing systems, An image model, Basic relationships betweenpixels and basic transformation, Image acquisition, sampling and quantization, Image fileformats, Two dimensional convolution, Two dimensional correlation, Two dimensionalfrequency responses.

UNIT-2: IMAGE TRANSFORMS

Study analysis with examples of 2D transforms, Transforms: DFT, DCT, Walsh,Hadamard, Slant, Haar, KLT, Radon, Hough,

UNIT-3: IMAGE ENHANCEMENT

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothingspatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering infrequency domain, image smoothing, image sharpening, Selective filtering.

UNIT-4: IMAGE RESTORATION

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least meansquare filter - Wiener filtering, Constrained least square restoration

UNIT-5: IMAGE SEGMENTATION AND RECOGNITION

Edge detection, Image segmentation: Region growing, Region splitting and merging, Edgelinking, Morphological operations: Dilation, Erosion, Opening, Closing, Image recognition:Patternsandpattern classes, Matching by minimum distance classifier, Statistical classifier,Matchingbycorrelation.

UNIT-6: IMAGE COMPRESSION

Need for image compression, Image coding, Huffman coding, Run length encoding, Arithmeticcoding, Vector Quantization, Block truncation coding, Transform coding, Image compressionstandards

TEXT BOOKS:

1. Rafeel C Gonzalez, Richard E Woods, 'Digital Image Processing', Pearson education, Inc., second edition, 2004.
2. Anil K Jain, 'Fundamentals of Digital Image Processing', Prentice hall of India
3. William K Pratt, 'Digital Image Processing' , John Wiley, New York, 2002

REFERENCES:

1. Lim JS, 'Two Dimensional Signal and Image Processing' , Prentice - hall New Jersey, 1990
2. Sid Ahmed M A, 'Image processing Theory, Algorithms and architectures', McGraw Hill, 1995
3. J T Tou and R.C. Gonzalez, 'pattern Recognition Principles', Addison Wesley publishing company
4. E. Gose and R. Johnson Bough, 'pattern Recognition and Image Analysis', Prentice hall of India

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C522**	**Phased Array Antennas (PE-I)**	**3**	**0**	**0**	**3**

UNIT – I
Introduction to Antennas, fundamentals of various antennas

UNIT – II
Conventional Scanning Techniques: Mechanical versus electronic scanning, Techniques of Electronic scanning, Frequency, Phase and time delay scanning principle, Hybrid scanning techniques.
UNIT – III
Array Theory: Linear and Planar arrays, various grid configurations, Concept of cell and grid, Calculation of minimum number of elements, Radiation pattern, Grating lobe formation, Rectangular and triangular grid design of arrays.
UNIT – IV
Feed Networks for phased Arrays: Corporate Feed, Lens and Reflect feed Techniques, Optimum f/d ratio, basic building block for corporate feed network, Series, Parallel feed networks, Comparison of various feeding techniques, Antenna Array Architecture, Brick/ Tile Type construction.
UNIT –V
Frequency Scanned Array Design: Snake feed, Frequency-phase scanning, Phase scanning, Digital phase shifter PIN diode and Ferrite phase shifters for phased arrays, Beam pointing errors due to digitization, Beam pointing accuracy.
UNIT – VI
Search Patterns: Calculation of search frame time, airborne phased array design, Electronic scanning radar, parameter calculation, Application of phased arrays, Phased Array Radar Systems, Active Phased Array, TR/ATR Modules.

TEXT BOOKS:
1. Olliner, A.A, and G.H. Knittel, “Phased Array Antennas”, Artech House, 1972.
2. Kahrilas. PJ, “Electronic Scanning Radar Systems Design Handbook”, Artech House, 1976.

REFERENCE BOOKS:
1. Skolnik. MI, “Radar Handbook”, McGraw Hill, NY, McGraw Hills-2007
2. Galati,G-(editor), “Advanced Radar Technique and Systems”, Peter Peregrinus Ltd, London, 1993.

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8DC71**	**Microprocessors and Microcontrollers Lab**	**0**	**0**	**2**	**1**

Course Objectives:

The objective of this course is to develop the Assembly language programming skills and real-time applications of Microprocessor as well as microcontroller.

***Course Outcomes**: After studying this course, the students will be able to*

CO1	*Explore to write the Assembly Language Programs using Arithmetic instructions of 8086*
CO2	*Explore to write the Assembly Language Programs using String instructions of 8086*
CO3	*Explore to write the Assembly Language Programs for I/O interface with 8086*
CO4	*Explore to write the Assembly Language Programs using Arithmetic instructions of 8051*
CO5	*Explore to write the Assembly Language Programs using Timers and interrupts of 8051*

Mapping of Course Outcomes with Program Outcomes

CO	**MPMCA Lab (8DC71)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*Explore to write the Assembly Language Programs using Arithmetic instructions of 8086*		2	2	2	2				2			3	3		
CO2	*Explore to write the Assembly Language Programs using String instructions of 8086*		3	3	3	3				2						
CO3	*Explore to write the Assembly Language Programs for I/O interface with 8086*		2	3	3	3				2					3	
CO4	*Explore to write the Assembly Language*		2	2	3	3				2			3	3		

	Programs using Arithmetic instructions of 8051															
CO5	*Explore to write the Assembly Language Programs using Timers and interrupts of 8051*		2	3	3	3				2						
CO	Overall		2	3	3	3				2			3	3	3	

Prerequisites:*STLD,LDICA*

Syllabus Content

Introduction to MASM/TASM, KIEL Assemblers
Familiarization with 8086, 8051 Kits

Cycle - I
8086 ALP using kit and MASM

1. Basic arithmetic and logical operations
2. Code conversion decimal arithmetic programs
3. String manipulation programs
4. Display a message on the screen of a computer using DOS / BIOS interrupts.

Cycle – II
Following peripherals and interfacing experiments to be implemented on 8086 and 8051 kits

1. A/D and D/A interfacing
2. Serial interfacing with PC
3. Keyboard and display interfacing
4. Stepper motor controller

Following simple programs may be given as lab assignment for students to executive at home by using 8086 emulator like EMU86 or MASM.

Write ALP and execute the program to

1. Find square of a number
2. Exchange two numbers
3. Find average of a given series of numbers
4. Add a constant to a series of values in memory & store the result back in memory
5. Find sum of cubes of a given series of numbers
6. Display squares of a given series of numbers in memory
7. Find factorial of a given number
8. Find largest number from a given series of numbers
9. Sort a series of given numbers in ascending order

10. Find whether the given number is even or odd number
11. Find sum of all even no.s from a given series of even and odd numbers
12. Find GCD of two given numbers
13. Find LCM of two given numbers
14. Display Fibonacci series
15. Reverse a String
16. Programs based on DOS/BIOS interrupts

Programs on 8051

1. Arithmatic Operations
2. Timers
3. Interrupts
4. Serial communication

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C577**	**VLSI Technology and Design Lab**	**0**	**0**	**4**	**2**

Prerequisites: *EDC, STLD, LDICA*

Course Outcomes*: After studying this course, the students must have demonstrated*

CO1	*An ability to use VLSI CAD Tools (NGSPICE, Xilinx, and Cadence).*
CO2	*An ability to understand and implement digital logic gates and circuits using SPICE and Verilog HDL.*
CO3	*An ability to perform physical design- layouts using Cadence EDA Tool.*
CO4	*An ability to implement combinatorial and sequential designs on FPGA boards (SPARTAN 3) using Xilinx tools.*
CO5	*An ability to use VLSI CAD Tools (NGSPICE, Xilinx, and Cadence).*

Mapping of Course Outcomes with Program Outcomes

CO	VLSI Technology and Design Lab (8C577)	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*An ability to use VLSI CAD Tools (NGSPICE, Xilinx, and Cadence).*	3	3	3	1	2				2	1	1	2	3	2	1
CO2	*An ability to understand and implement digital logic gates and circuits using SPICE and Verilog HDL.*	3	3	3	1	2				2	1	1	2	3	2	1
CO3	*An ability to perform physical design- layouts using Cadence EDA Tool.*	3	3	3	1	2				2	1	1	2	3	2	1
CO4	*An ability to implement combinatorial and sequential designs on FPGA boards (Artix-7) using Xilinx tools.*	3	3	3	1	2				2	1	1	2	3	2	1

CO5	*An ability to use VLSI CAD Tools*	3	3	3	1	2				2	1	1	2	3	2	1
CO		3	3	3	1	2				2	1	1	2	3	2	1

Syllabus Content

PART A

The following Experiments are to simulate the design in Xilinx Vivado2017.1 using Verilog HDL and implement it on Artix 7 FPGA.

1. Design of all Logic Gates.
2. Design of Adders(Half Adder,FullAdder,Parallel Adder).
3. Design of 3-8 Decoder.
4. Design of 8-3 Encoder.
5. Design of 8*1Multiplexer.
6. Design of 4*1 Demultiplexer.
7. Design of Flip-flops:D,SR,JK,T.
8. Design of 4-bit Comparator.

PART B

The following Experiments are to Design and Verify the Operation using Cadence Tool.

1. Design and Simulatethe CMOS Inverter.
2. Design and Simulate the CMOS AND Gate.
3. Design and Simulate the CMOS OR Gate.
4. Design and Simulate the CMOS NAND Gate.
5. Design and Simulate the CMOS NOR Gate.
6. Design and Simulate the CMOS Ex-OR Gate.
7. Design and Simulate the CMOS Ex-NORGate.
8. Design and Simulate the Layout diagram for CMOS Inverter using 180nm Technology.

Note: Any Six Experiments From Each Part.

Part-D Lab Project –

1. Hierarchical design and layout of MSI circuits (multiplexer, decoders, etc.)
2. FPGA based traffic light controller using Verilog HDL
3. FPGA based Beverage Vending Machine
4. FPGA based UART serial communication interface
5. Implement 8-bit 3-stage pipeline processor
6. Using SPICE Implement 6T SRAM memory with read and write logic

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8FC72**	**Python Programming Lab**	**0**	**0**	**4**	**2**

Course Objectives

Students will try to learn

- Basics of Python programming, Decision Making and Functions in Python, Object Oriented Programming using Python.
- To introduce to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers.

Course outcomes

Students will be able to

1. Apply knowledge for computer assembling and software installation and ability to solve the trouble shooting problems.
2. Apply the tools for preparation of PPT, Documentation and budget sheet etc.
3. Install and run the Python interpreter, Create and execute Python programs.
4. Apply the best features of mathematics, engineering and natural sciences to program real life problems.
5. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python, Express different Decision Making statements and Functions, Interpret Object oriented programming in Python.
6. Understand and summarize different File handling operations, explain how to design GUI Applications in Python.

CO	**Python Programming Lab (8FC72)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Apply knowledge for computer assembling and software installation and ability to solve the trouble shooting	2	2	2	2	3				3				2	2	

	problems															
CO2	Apply the tools for preparation of PPT, Documentation and budget sheet etc	3	3	3	3	3				3				3	2	
CO3	Install and run the Python interpreter, Create and execute Python programs	3	2	3	3	3				3				2	3	
CO4	Apply the best features of mathematics, engineering and natural sciences to program real life problems	3	3	3	2	3				3				3	3	
CO5	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python, Express different Decision Making statements and Functions, Interpret	3	3	3	3	2				3				3	3	

	Object oriented programming in Python															
CO6	Understand and summarize different File handling operations, explain how to design GUI Applications in Python	3	3	3	2	3				3				3	3	
CO	overall	3	3	3	3	3				3				3	3	

Python Programming Lab

Week -1:

1. Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
2. Start the Python interpreter and type help() to start the online help utility.
3. Start Python interpreter and use it as Calculator.

Week -2:

4. If you run a 10 kilometer race in 43 minutes 30 seconds, what is your average time per mile? What is your average speed in miles per hour? (Hint: there are 1.61 kilometers in a mile).
5. The volume of a sphere with radius r is 5? (Use Sphere volume formula)

6. Suppose the cover price of a book is $24.95, but bookstores get a 40% discount. Shipping costs $3 for the first copy and 75 cents for each additional copy. What is the total wholesale cost for 60 copies?

Week -3:

7. A function object is a value you can assign to a variable or pass as an argument. For example, do_twice is a function that takes a function object as an argument and calls it

twice:

```
defdo_twice(f):
f()
f()
```

Here’s an example that uses do_twice to call a function named print_spam twice.

```
defprint_spam():
print'spam'
do_twice(print_spam)
```

a. Type this example into a script and test it.

b. Modify do_twice so that it takes two arguments, a function object and a value, and calls the function twice, passing the value as an argument.

c. Write a more general version of print_spam, called print_twice, that takes a string as a parameter and prints it twice.

d. Use the modified version of do_twice to call print_twice twice, passing 'spam' as an argument.

8. Write a function that draws a grid like the following:

```
+ - - - - + - - - - +
|       |       |
|       ||
|       |       |
+ - - - - + - - - - +
|       |       |
|       |       |
|       |       |
|       |       |
+ - - - - + - - - - +
```

Hint: to print more than one value on a line, you can print a comma-separated sequence.

9. Write a function called gcd that takes parameters a and b and returns their

greatest common divisor.

10. Write a function called is_palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.

Week-4:

11. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
12. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
1. Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
2. The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
3. Write a python code to read a dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.

Week-5:

4. If there are 23 students in your class, what are the chances that two of you have the same birthday? You can estimate this probability by generating random samples of 23 birthdays and checking for matches.
Hint: you can generate random birthdays with the randint function in the random module.

5. How does a module source code file become a module object?
6. Why might you have to set your PYTHONPATH environment variable?
7. What is a namespace, and what does a module's namespace contain?
8. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
9. What is the purpose of a _ _init_ _.py file in a module package directory? Explain with a suitable example.
10. Use the structure of exception handling all general purpose exceptions.

Week-6:

11. a. Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.

b. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.

c. Write a function called draw_point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.

d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw_circle that draws circles on the canvas.

12. Write a Python program to demonstrate the usage of MRO in multiple levels of Inheritances.
13. Write a python code to read a phone number and email-id from the user and validate it for correctness.

Week-7:

14. Write a Python code to merge two given file contents into third file.
15. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.

Week-8:

16. Import numpy, Plotpy and Scipy and explore their functionalities.
17. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8C591**	**Summer Industry Internship-I**	**0**	**0**	**1**	**1**

Course Objective:

The students undergo industrial training so that he/she become industry-ready.

Course Outcomes:

At the end of the training, the student is able to

1. Select the real-time problem in the industry.
2. Analyze the requirements with respect to the problem statement
3. Design the optimal solution for the problem.
4. Implement the solution using the appropriate modern tools.
5. Present and submit the report

Mapping of Course Outcomes with Program Outcomes

CO	**Summer Industry Internship-I (8C591)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Select the real-time problem in the industry.	2	2	2	2	3				3				2	2	
CO2	Analyze the requirements with respect to the problem statement		3	2	2	3				3				2	2	
CO3	Design the optimal solution for the problem.			3	2	3				3				1	2	
CO4	Implement the solution using the apropriate modern tools	2	2	2	3	3				3				2	3	
CO5	Present and submit the report	3	3	3	3	3				3				3	3	
CO	Overall					3				3				2	2	

Student shall carryout the project in industry during summer vacation for 3-6 weeks. There is internal and external Evaluation. Internal Evaluation carries 30 marks and external Evaluation carries 70 marks, Total 100 marks.

Syllabus for B. Tech (E.C.E.) III Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - I	**8FC24**	**Cyber Security**	**2**	**0**	**0**	**0**

Course Objectives:

- To familiarize with network security, network security threats, security services, and countermeasures.
- To be aware of computer security and Internet security.
- To study the defensive techniques against these attacks.
- To familiarize with cyber forensics.
- To be aware of cyber crime related to mobile and laptop etc.
- To acquire knowledge relating to Cyberspace laws and Cyber crimes.
- To understand ethical laws of computer for different countries, Offences under the Cyberspace and Internet in India.

Course Outcomes:

At the end of this course the student will be able to

1. The students will be able to understand cyber-attacks, types of cybercrimes.
2. Realize the importance of cyber security and various forms of cyber attacks and countermeasures.
3. Get familiar of cyber forensics.
4. Get familiar with obscenity and pornography in cyber space and understand the violation of Right of privacy on Internet.
5. Cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.
6. Elucidate the various chapters of the IT Act 2008, power of Central and State Government to make rules under IT Act 2008.

CO	CYBER SECURITY (8FC24)	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	The students will be able to understand cyber-attacks, types of cybercrimes.		2				2							1		
CO2	Realize the importance of cyber security and various forms		2				2							1		

	of cyber attacks and countermeas ures															
CO3	Get familiar of cyber forensics		2				2							1		
CO4	Get familiar with obscenity and pornography in cyber space and understand the violation of Right of privacy on Internet		2				2							1		
CO5	Cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks		2				2							1		
CO6	Elucidate the various chapters of the IT Act 2008, power of Central and State Government to make rules under IT Act 2008		2				2							1		
CO			2				2							1		

UNIT-I: Introduction to cyber Security

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of

defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc.,

UNIT-II: Cyber Forensics:
Introduction to cyber forensic, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT-III: Cybercrime: Mobile and Wireless Devices:

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops and desktop.

UNIT-IV: Cyber Security: Organizational Implications:
Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.
Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT-V: Privacy Issues:
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

UNIT-VI: Cyberspace and the Law &Miscellaneous provisions of IT Act.
Introduction to Cyber Security Regulations, International Law. The INDIAN Cyberspace, National Cyber Security Policy. Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threats.
Other offences under the Information Technology Act in India, The role of Electronic Evidence and miscellaneous provisions of the IT Act.2008.

Cybercrime: Examples and Mini-Cases
Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS:
1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCE BOOKS:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.
3. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2ndEdition, O' Reilly Media, 2006.
4. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, New Delhi, 2006.
5. Cyberspace and Cybersecurity, George Kostopoulos, Auerbach Publications, 2012.
6. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, Second Edition, Albert Marcella, Jr., Doug Menendez, Auerbach Publications, 2007.
7. Cyber Laws and IT Protection, Harish Chander, PHI, 2013

III – II

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8EC47**	**Computer Networks**	**2**	**0**	**0**	**2**

Course Objective:

1. The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols and functions of the various layers.

Course Outcomes:

At the end of this course, the student will be able to

1 Classify network topologies and apply the same to different networks with the knowledge acquired from the network reference models and fundamentals of computer networks
2 Illustrate the design issues of data link layer and detect the transmission errors and flow control problems
3 Categorize the Channel allocation issues, MAC protocols such as ALOHA, CSMA and CSMA/CD and MAC addresses with IEEE 802.X and wireless LAN.
4 Distinguish the knowledge of the several routing algorithms and Internetworking concepts.
5 Obtain and use the skills of subnetting and routing mechanisms
6 Distinguish the knowledge of the functions of transport and application layer

CO	**Computer Networks (8EC47)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Classify network topologies and apply the same to different networks with the knowledge acquired from the network reference models and fundamentals of computer networks		3		2									3		
CO2	Illustrate the design issues of data link layer and detect the transmission errors and flow control problems		3		2									2		
CO3	Categorize the Channel allocation issues, MAC protocols		3		2									2		

	such as ALOHA, CSMA and CSMA/CD and MAC addresses with IEEE 802.X and wireless LAN															
CO4	Distinguish the knowledge of the several routing algorithms and Internetworking concepts		3		2											
CO5	Obtain and use the skills of subnetting and routing mechanisms		3		2									2		
CO6	Distinguish the knowledge of the functions of transport and application layer		3		2									2		2
CO	Overall		3		2									2		2

UNIT I

Introduction: Uses of Computer Networks, Types of networks: WAN, LAN, MAN, Network Topologies, Reference models: OSI, TCP/IP.

Physical Layer: Transmission media: magnetic media, twisted pair, coaxial cable, fiber optics, wireless transmission.

UNIT II

Data link layer: Design issues in data link layer: framing, flow control, error control, Error Detection and Correction: Parity, CRC checksum, Hamming code, Flow Control: Sliding Window Protocols, Applications: Data link layer protocols HDLC, PPP.

UNIT III

Medium Access sub layer: Channel allocation problem, MAC Protocols: ALOHA, CSMA, CSMA/CD, MAC addresses, IEEE 802.X, Standard Ethernet, Wireless LANS. Bridges, Types of Bridges.

UNIT IV

Network Layer: Design issues in Network Layer, Virtual circuit and Datagram subnets-Routing algorithm: Shortest path routing, Flooding, distance vector routing, Link state routing, Hierarchical routing, Broad casting, Multi casting, Routing for mobile hosts.

Internetworking: Concatenated Virtual Circuits, Connectionless internetworking, Tunneling, Internetwork routing, Fragmentation

UNIT V

Network layer in internet: IPv4, IP addresses, Sub netting, Super netting, NAT.Internet control protocols: ICMP, ARP, RARP, DHCP**.**

Congestion Control: Principles of Congestion, Congestion Prevention Policies.

Congestion Control in datagram Subnet: Choke packet, load shedding, jitter control.

Quality of Service: Leaky Bucket algorithm and token bucket algorithm.

UNIT VI

Transport Layer: Transport Services, Connection establishment, Connection release and TCP and UDP protocols.

Application Layer: Domain name system, FTP, HTTP, SMTP, WWW.

Textbook & Course Materials

Required Textbooks

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networking – Behrouz A. Forouzan.Third Edition TMH.
3.Data Communication and Networks-BhushanTrivedi-OXFORD Publications.

Recommended Textbooks & Other Readings

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C613**	**Microwave and Optical Communications**	**3**	**0**	**0**	**3**

Prerequisites: *EMWTL, AWP*

Course Objectives:

The objectives of this course are

- *To have fundamental understanding of microwave components and circuits in terms of scattering parameters, electrical characteristics of waveguides and transmission lines through electromagnetic field analysis*
- *To expose the students to the basics of signal propagation through optical fibers, optical sources and detectors.*

Course Objectives*: After studying this course, the students will be able to*

CO1	*Distinguish microwave frequencies and analyze Rectangular and circular wave guides.*
CO2	*Formulate various passive components with the help of scattering matrix*
CO3	*Explore different linear beam tubes*
CO4	*Analyze Cross field tubes and slow wave structures.*
CO5	*Analyze the propagation of light in optical fibers and to characterize various optical sources.*
CO6	*Understand the principle of various Losses, Dispersion and to characterize various Optical Detectors.*

Mapping of Course Outcomes with Program Outcomes

CO	**Microwave and Optical Communications (8C613)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Distinguish microwave frequencies and analyze Rectangular and circular wave guides.		2	2		2	2	2					2	3	2	
CO2	Formulate various passive components with the help of scattering matrix		2		2	2		3					2	3	2	
CO3	Explore different linear beam tubes	1	2	2	2	2		3					2	3	2	
CO4	Analyze Cross field tubes and slow wave structures	1	2	2		2		3					2	3	2	
CO5	Analyze the propagation of light in optical fibers and to characterize	2	2	3		2	2	3					2	3	2	2

	various optical sources															
CO6	Understand the principle of various Losses, Dispersion and to characterize various Optical Detectors.	2	2	3		2	2	3					2	3	2	2
CO	Overall	2	2	2	2	2	2	3					2	3	2	2

UNIT-I

Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Cut-off Frequencies, Dominant Modes, Mode Characteristics – Phase and Group Velocities, Wavelength and Impedance Relations; Dominant and evanescent modes; Power Transmission and Power Losses in Rectangular Wave Guide, Related Problems.

UNIT-II

Introduction to micro strip lines, losses, Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts. Matched Load, Waveguide Attenuators, Phase Shifters. Waveguide Multiport Junctions – E and H plane Tees, Magic Tee, Hybrid Ring; Directional Couplers. Scattering Matrix– Significance, Formulation and Properties, Directional Coupler, Magic Tee, Circulator and Isolator. Related Problems.

Ferrite Components: Ferrite Characteristics, Faraday rotation, Gyrator, Isolator, and Circulator

UNIT-III

Limitations and Losses of conventional tubes at microwave frequencies. Microwave tubes – O type and M type classifications. O-type tubes: 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process. O/P Power and Efficiency, Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Bunching process, Power Output, Efficiency Electronic Admittance; Oscillating Modes and o/p Characteristics, Related Problems.

UNIT-IV

Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.four propagation constants.

M-TYPE TUBES: Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron operations and o/p characteristics. PI mode and its significance. – Hull Cut-off Condition.

UNIT-V

Introduction, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays. Fibers- Modes, V Number, Mode Coupling, Step Index Fibers, Graded Index Fibers. Single Mode Fibers- Cut off Wavelength, Mode Field Diameter, Effective Refractive Index.

Optical Sources: Construction and working principles of LED and LASER diaodes.

UNIT-VI

Transmission Characteristics Of Optical Fiber -Attenuation - Material Losses absorption in silica glass fiber - Linear and Non Linear Scattering Losses - Intra and Inter-Modal Dispersion - All Over Fiber Dispersion - Optical fiber connectors, fiber alignment and Joint Losses - Fiber Splicer - Fiber Connectors - Expanded Beam Connectors - Fiber Couplers.

Optical Detectors: Physical principles of PIN and APD, Comparison of Photo detectors.

TEXT BOOKS

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition, 1994.
2. Microwave Principles – Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004.
3. Optical Fiber Communications – Gerd Keiser, McGraw-Hill International edition, 3rd Edition, 2000.
4. Micro Wave and Radar Engineering – M. Kulkarni, Umesh Publications, 1998

REFERENCES

1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Microwave Circuits and Passive Devices – M.L. Sisodia and G.S.Raghuvanshi, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995.
3. Microwave Engineering, RaghuvanshiG.S. , 1st edition, Cengage Learning
4. Microwave Engineering Passive Circuits – Peter A. Rizzi, PHI, 1999.
5. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th ed., 1955.
6. Elements of Microwave Engineering – R. Chatterjee, Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
7. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8EC45**	**Artificial Intelligence**	**2**	**0**	**0**	**0**

Course objective:

To learn the distinction between optimal reasoning Vs. human like reasoning. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities. To learn different knowledge representation techniques. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

COURSE OUTCOMES:

At the end of this course the student will be able to

1. Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
2. Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
3. Learn different knowledge representation techniques.
4. Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and spacecomplexities.
5. Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
6. Analyze Supervised Learning Vs. Learning DecisionTrees

CO	**Artificial Intelligence (8EC45)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed	3	2	2	2									3		

	in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.															
CO2	Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.	2	2	3	2									3		
CO3	Learn different knowledge representation techniques.	2	2	2	3								2	3		
CO4	Understand the concepts of state space representation,	2	2	2	2								2	3		

	exhaustive search, heuristic search together with the time and spacecomplexities.															
CO5	Comprehend the applications of Probabilistic Reasoning and Bayesian Networks	2	2	2	2								2	3		
CO6	Analyze Supervised Learning Vs. Learning DecisionTrees	2	2	3	3								2	3		
CO	overall	2	2	2	3								2	3		

UNIT - I

Introduction to AI, Intelligent Agents, Problem-Solving Agents, Searching for Solutions, Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

UNIT-II

Games, Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

UNIT-III

Representation, Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution. **Knowledge Representation:** Ontological Engineering, Categories and Objects, Events.

UNIT-IV

Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

UNIT-V

Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The

Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

Unit-VI

Learning: Forms of Learning, Supervised Learning, Learning Decision Trees.

TEXT BOOKS:

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCES:

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight(TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, PearsonEducation.
3. Artificial Intelligence, ShivaniGoel, PearsonEducation.
4. Artificial Intelligence and Expert systems – Patterson, PearsonEducation.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8AC07**	**Linear Control system**	**3**	**0**	**0**	**3**

Course Objective: Students learn about fundamental concepts of time and frequency domain analysis of a given system.

Course Outcomes: Students

1. Learn basic concepts of control systems.
2. Study about time response analysis.
3. Learn basic concepts of stability and root locus method.
4. Study about frequency response analysis.
5. Learn basic concepts stability analysis in frequency domain.
6. Learn fundamentals of state space analysis.

CO	**Linear Control system (8AC07)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Learn basic concepts of control systems.		2	2									1	2		
CO2	Study about time response analysis.	2	2	2									1	2		
CO3	Learn basic concepts of stability and root locus method.	2	2	2									1	2		
CO4	Study about frequency response analysis.	2	2	2									1	2		
CO5	Learn basic concepts stability analysis in frequency domain.	2	2	2									1	2		
CO6	Learn fundamentals of state space analysis.	2	2	2									2	2		
CO7	Overall	2	2	2									1	2		

UNIT – I INTRODUCTION:

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models –

Differential equations, Impulse Response and transfer functions – Translational and Rotational mechanical systems

Transfer function representation:

Transfer Function of Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT-II TIME RESPONSE ANALYSIS:

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems, PID controllers.

UNIT – III STABILITY ANALYSIS IN S-DOMAIN:

The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.

Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT – IV FREQUENCY RESPONSE ANALYSIS:

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

UNIT – V STABILITY ANALYSIS IN FREQUENCY DOMAIN:

Polar Plots-Nyquist Plots-Stability Analysis.

CLASSICAL CONTROL DESIGN TECHNIQUES: Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain.

UNIT – VI STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS:

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties.

TEXT BOOKS:

1. Automatic Control Systems 8th edition –B. C. Kuo 2003– John wiley and sons.
2. Control Systems Engineering – I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.

REFERENCES:

1. Modern Control Engineering – Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Control Systems – N.K. Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998.
3. Control Systems Engg. – NISE 3rd Edition – John wiley.
4. "Modeling & Control of Dynamic Systems" – Narciso F. Macia George J. Thaler, Thomson Publishers.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C623**	**Analog and Mixed Signal Design (PE-II)**	**3**	**0**	**0**	**3**

Course Objectives:

This course will introduce design and analysis of mixed-signal integrated circuits. Apply principles of hierarchical mixed signal CMOS VLSI, from the transistor up to the system level, to the understanding of CMOS circuits and systems

Course Outcomes*: After studying this course, the students will be able to*

CO1	*Understand the concepts of Switched capacitors Circuits*
CO2	*know the concepts of PLLS*
CO3	*study concepts of Data Converter Fundamentals*
CO4	*Explore the concepts of Nyquist Rate A/D Converters and develop its applications*
CO5	*Understand concepts of the Oversampling Converters and Continuous-Time Filters*
CO6	*Understand concepts of concepts of Continuous-Time Filters, CMOS Trans conductors*

Mapping of Course Outcomes with Program Outcomes

CO	Analog and Mixed Signal Design (8C623)	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	*Understand the concepts of Switched capacitors Circuits*	1	3	1	1	2				2	1	1	2	3	2	1
CO2	*know the concepts of PLLS*	1	1	1	1	2				2	1	1	2	2	2	1
CO3	*study concepts of Data Converter Fundamentals*	1	2	2	1	2				2	1	1	2	3	2	1
CO4	*Explore the concepts of Nyquist Rate A/D Converters and develop its applications*	1	2	2	1	2				2	1	1	2	2	2	1

CO5	*Understand concepts of the Oversampling Converters and Continuous-Time Filters*	1	1	1	1	2				2	1	1	2	1	2	1
CO6	*Understand concepts of concepts of Continuous-Time Filters, CMOS Trans conductors*	1	1	2	1	2				2	1	1	2	1	2	1
CO		1	1	2	1	2				2	1	1	2	1	2	1

UNIT I

Switched Capacitor Circuits: Introduction to Switched Capacitor circuits basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, Biquad filters.

UNIT II

Phased Lock Loop (PLL): Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non idealities, Jitter in PLLs, Delay locked loops, applications.

UNIT III

Data Converter Fundamentals: DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters.

UNIT IV

Nyquist Rate A/D Converters: Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-interleaved converters.

UNIT V

Oversampling Converters: Noise shaping modulators, Decimating filters and Interpolating filters, Higher order modulators, Delta sigma modulators with multi-bit quantizers, Delta sigma D/A.

UNIT VI

Continuous-Time Filters: Introduction to Gm-C Filters, Bipolar Trans conductors, CMOS Trans conductors Using Triode and Active Transistors, Bi CMOS Tran conductors, MOSFET-C Filters.

Text Books:

1. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition, 2002

2. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition, 2013

Reference Books:

1. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience, 2009.

2. CMOS Analog Circuit Design –Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C624**	**Embedded C Programming (PE-II)**	**3**	**0**	**0**	**3**

Course Objectives:

The objectives of this course are

- *To provide basic knowledge in embedded system design using Embedded C.*
- *To make the learners understand concept and applications of Embedded C Programming in various fields including industrial automation..*

Course Outcomes*: After studying this course, the students will be able to*

CO1	*Demonstrate the use of development software for a particular application and choosing appropriate OS.*
CO2	*Understanding and building basic embedded system using 8051.Understanding its design*
CO3	*Design of embedded systems and implementation of switch reading.*
CO4	*Demonstrate the concepts of OOP's theory inheritance and functions in embedded C to support modular programming.*
CO5	*Learning the need for realtime implementation in Embedded C..*
CO6	*Case study of 'Intruder Alarm" toachihve real time hands on.*

Mapping of Course Outcomes with Program Outcomes

CO	**Embedded C Programming (8C624)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*Demonstrate the use of development software for a particular application and choosing appropriate OS.*	3	2	2		1							3	3		
CO2	*Understanding and building basic embedded system using 8051.Understanding its design*	1	3	3						3						
CO3	*Design of embedded systems and*	1	2	3		3	3			3					3	

	implementation of switch reading.				3											
CO4	*Demonstrate the concepts of OOP's theory inheritance and functions in embedded C to support modular programming*	3	2	2		1							3	3		
CO5	*Learning the need for realtime implementation in Embedded C.*	1	2	3						3						
CO6	*Case study of 'Intruder Alarm" toachihve real time hands on*	2		3	3	3	3			3					3	
CO	overall	2	2	3	3	2	3			3			3	3	3	

Syllabus Content

UNIT – I:

Programming Embedded Systems in C

Introduction ,What is an embedded system, Which processor should you use, Which programming language should you use, Which operating system should you use, How do you develop embedded software, Conclusions

UNIT – II:

Introducing the 8051 Microcontroller Family

Introduction, What's in a name, The external interface of the Standard 8051, Reset requirements ,Clock frequency and performance, Memory issues, I/O pins, Timers, Interrupts, Serial interface, Power consumption ,Conclusions

UNIT – III:

Reading Switches

Introduction, Basic techniques for reading from port pins, Example: Reading and writing bytes, Example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), Example: Counting goats, Conclusions

UNIT – IV:

Adding Structure to the Code

Introduction, Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the 'Hello Embedded World' example, Example: Restructuring the goat-counting example, Further examples, Conclusions

UNIT – V:

Meeting Real-Time Constraints

Introduction, Creating 'hardware delays' using Timer 0 and Timer 1, Example: Generating a precise 50 ms delay, Example: Creating a portable hardware delay, Why not use Timer 2?, The need for 'timeout' mechanisms, Creating loop timeouts, Example: Testing loop timeouts, Example: A more reliable switch interface, Creating hardware timeouts, Example: Testing a hardware timeout, Conclusions

UNIT – VI:

Case Study: Intruder Alarm System

Introduction, The software architecture, Key software components used in this example, running the program, the software, Conclusions

TEXT BOOKS:

1. Embedded C - Michael J. Pont, 2nd Ed., Pearson Education, 2008

REFERENCE BOOKS:

1. PICmicro MCU C-An introduction to programming, The Microchip PIC in CCS C - Nigel Gardner

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C625**	**Transform Techniques (PE-II)**	**3**	**0**	**0**	**3**

Course Objectives

1. To learn basics of two-dimensional transform.
2. Understand the various two-dimensional transform definition, properties and applications.
3. Understand the design of filter Bank structure.
4. To learn the fundamentals of wavelet, transform and special wavelets.

Course Outcomes: On completion of this course student will be able to:

1. The student will learn basics of two-dimensional transforms.
2. Understand the definition, properties and applications of various two-dimensional transform.
3. Understand the basic concepts of wavelet transform.
4. Understand the special topics such as wavelet packets, Bi-orthogonal wavelets e.t.c.

CO	**Transform Techniques (8C625)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*Use the Laplace transforms techniques for solving ODE's*	3	3	3		3								3	2	
CO2	*Use the Z-Tranforms technique for solving Difference equations*	3	3	3		3								3	2	
CO3	*Form partial differential equations and find the solution to first order linear and nonlinear partial differential equations*	3	3	3		3								3	2	
CO4	*Find the root of a given equation*	3	3	3		3								3	2	

CO5	*Estimate the value for the given data using interpolation*	3	3	3		3								3	2	
CO6	*Find the numerical solutions for a given ODE's*	3	3	3		3								3	2	
CO	OVERALL	3	3	3		3								3	2	

UNIT –I
Review of Signals, classification of signals, Vector Analogy and Signal Analogy, Vector space, Hilbert spaces, Need of Transform techniques

UNIT -II
Fourier Analysis: Fourier basis, FT- Limitations of Fourier Analysis, Need for time-frequency analysis, DFT, 2D-DFT: Definition, Properties and Applications, IDFT, Hilbert Transform, STFT.

UNIT -III
Transforms: Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT, – definition, properties and applications

UNIT -IV
Continuous Wavelet Transform (CWT): Short comings of STFT, Need for wavelets, Wavelet Basis- Concept of Scale and its relation with frequency, Continuous time wavelet Transform Equation- Series Expansion using Wavelets- CWT- Tiling of time scale plane for CWT. Important Wavelets: Haar, Mexican Hat, Meyer, Shannon, Daubechies.

UNIT -V
Multi Rate Analysis and DWT: Need for Scaling function – Multi Resolution Analysis, Two-Channel Filter Banks, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet Basis, DWT, Structure of DWT Filter Banks, Daubechies Wavelet Function, Applications of DWT.

UNIT -VI
Special Topics: Wavelet Packet Transform, Multidimensional Wavelets, Bi-orthogonal basis- BSplines, Lifting Scheme of Wavelet Generation, Multi Wavelets

TEXT BOOKS:
1. Wavelet Transforms-Introduction theory and applications -RaghuveerM.Rao and Ajit S. Bopardikar, Pearson Edu, Asia, New Delhi, 2003.
2. "Insight into Wavelets from Theory to practice ", Soman. K. P, Ramachandran. K.I, Printice Hall India, First Edition, 2004.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C626**	**Software Defined Radio(PE-II)**	**3**	**0**	**0**	**3**

Course Objectives

1. This course describes the fundamental radio components and how these components are implemented in software.
2. The principles of software architecture to support the SDR will be developed. Policy and cooperation mechanisms that enable SDR to interoperate will be developed.
3. Basic principles of Cognitive Radio (CR) which is an extended form of SDR will be introduced.
4. In this course you will study SDR & CR and investigate their role in future communication systems.

Course Outcomes

Students who successfully complete this course will have

1. *An ability to make system-level decisions for software-defined radio technology and products*
2. *An ability to implement smart antenna algorithms*
3. *Knowledge of digital hardware architectures and understanding of development methods*
4. *An understanding of middleware in SDR*
5. *Understanding of analog RF components&Understand the basic principles of Cognitive Radio*

Mapping of Course Outcomes with Program Outcomes

CO	**Software Defined Radio (8C626)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	An ability to make system-level decisions for software-defined radio technology and products	2	2										2	2		2
CO2	An ability to implement smart antenna algorithms		2	2		3							2	2	3	2
CO3	Knowledge of digital hardware architectures and understanding of development methods			3		3							2	2	3	2
CO4	An understanding of middleware in SDR		2										2	2	2	2
CO5	Understanding of analog RF components		2										2	2		2

CO6	Understand the basic principles of Cognitive Radio		2										2	2		2
CO	Overall	2	2	3		3							2	2	3	2

UNIT I

Introduction to SDR

What is a Software Radio? The need for Software Radios, Characteristics and benefits of a Software Radio, Design principles of Software Radio

UNIT-II

Radio frequency implementation issues

The purpose of the RF Front-End, Dynamic range: The principal challenge of receiver design. RF receiver front-end topologies, Enhanced flexibility of the RF Chain with Software Radios, Importance of the components to overall performance, Transmitter architectures and their Issues, noise anddistortion in the RF Chain, ADC and DAC distortion

UNIT-III

Digital hardware choices

Key hardware elements, DSP Processors, Field Programmable Gate Arrays, Trade-offs in using DSPs, FPGAs and ASICs, Power management issues, Combination of DSPs, FPGAs, and ASICs.

UNIT-IV

Digital generation of signals

Comparison of direct digital synthesis with analog signal synthesis, Approaches to direct digital synthesis, Analysis of spurious signals, Spurious components due to periodic jitter, Band pass signal generation, Performance of direct digital synthesis systems, Hybrid DDS-PLL Systems, Applications of Direct Digital Synthesis, Generation of random sequences.

UNIT-V

Analog to digital and digital to analog conversion

Parameters of ideal data converters, Parameters of practical data converters, Techniques to improve data converter performance, Common ADC and DAC architectures

UNIT-VI

Introduction to Cognitive Radio

Motivation of Cognitive Radio, Dynamic Spectrum Access, User hierarchy in cognitive radio networks, Usage scenarios for cognitive radio, Cognitive Cycle, Spectrum Management: spectrum sensing, spectrum decision, spectrum mobility, spectrum sharing, Classification of spectrum sensing techniques..

Text Books:

1. J.H. Reed, '*Software-Radio, A Modern Approach to Radio Engineering* ', Prentice-Hall, 2002
2. EzioBiglieri, Andrea. J. Goldsmith, Larry J. Greenstein, Narayan B. Mandayam,H. Vincent Poor, '*Principles of Cognitive Radio'*, Cambridge University Press.

References:

1. Joseph Mitola '*Software Radio Architecture: Object-Oriented Approaches to Wireless Systems Engineering*' Wiley-Interscience; 1st edition2000

2. Yong SooCho,Jaekwon Kim, Won YoungYang, Chung G. Kang '*MIMO-OFDM Wireless Communications with MATLAB*' John Wiley & Sons (2010).

3. Mohamed Ibnkahla' Cooperative Cognitive Radio Networks, The Complete Spectrum Cycle', CRC Press.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C627**	**Artificial Neural Networks (PE-II)**	**3**	**0**	**0**	**3**

Course Objectives:

The objectives of this course are

- *To study the concepts of Artificail intelligence and computer vision and also the applications of Neural networks*

Course Outcomes*: After studying this course, the students will be able to*

CO1	*Understand the concepts of Artificial Intelligence*
CO2	*Illustrate the concepts of Artificial Neural system*
CO3	*I*llustrate *computer vision*
CO4	*Explain Probabilistic models and neural networks*
CO5	*Illustrate concept Neural language*
CO6	*Explain applications of Neural networks*

CO	**Artificial Neural Networks (8C627)**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	*Understand the concepts of Artificial Intelligence*	3	2	2	2									3		
CO2	*Illustrate the concepts of Artificial Neural system*	2	2	3	2									3		
CO3	*I*llustrate *computer vision*	2	2	2	3								2	3		
CO4	*Explain Probabilistic models and neural networks*	2	2	2	2								2	3		
CO5	*Illustrate concept Neural language*	2	2	2	2								2	3		
CO6	*Explain applications of Neural networks*	2	2	3	3								2	3		
Overall PO mapping		2	2	2	3								2	3		

UNIT - I

Artificial Intelligence: Definition, Study of AI techniques, problems and Problems space, AI characteristics, Heuristics. Problem solving Methods: Forward and backward reasoning, problem trees,

problem graph, hill climbing, search method, problem reduction, constraint satisfaction, means and analysis, game playing, mini max algorithms, alphabetic heuristics.

UNIT - II:

Introduction:

Introduction to ANS (Artificial Neural systems) Technology, ANS simulation, Types of Neural Networks: Hopfield, perceptron and related models, Adaline and Madaline: Adaline and the Adaptive Linear Combiner, the Madaline and simulating the Adaline. Essential vector operations, Lateral Inhibition and Sensory Processing.

UNIT - III

Computer Vision:

Perception, early processing, representation and recognition of scenes, Guzman‟s algorithms of spurting objects in a scene, Waltz algorithm.

UNIT - IV:

Probabilistic Models, Fuzzy ARTMAP and Recurrent Networks:-Probabilistic Neural Networks, General Regression Neural Networks, Fuzzy ARTMAP, Recurrent Back propagation Neural Networks, Hybrid Learning Neural Networks:-Counter propagation Network, Radial basis Function Networks.

UNIT - V

Neural Language understanding problems, syntactic analysis, semantic analysis, augmented transition networks.

UNIT - VI

Application of Neural Networks:- Design and optimization of Systems: Non-Linear optimization, Inverse design

problems, Pattern Recognition Applications: Control Chart pattern Recognition, Recognition of Machine-Cells in a group technology layout. Complex pattern Recognition tasks: Pattern mapping, Temporal patters, pattern variability, Neocognitron, Addition of lateral inhibition and Feedback to the Neocognitron.

SUGGESTED READING:

1. Elaine Rich, Artificial Intelligence, McGraw Hill, 1985. 2. Nilson, Principles of Artificial Intelligence. 3. Winston, The Psychology of Computer.
2. Nilson, Principles of Artificial Intelligence. 3. Winston, The Psychology of Computer.
3. James A. Freeman and David M. Skapura,Neural Networks; Algorithms Applications and Programming Techniques, Pearson Education, India,2008.
4. James A. Anderson ,An introduction to Neural Networks ,PHI,2003.
5. B.Yegnanarayana,Artificial Neural Networks, PHI Publications India,2006.
6. M.AnandaRao and J.Srinivas, Neural Networks: Algorithms and Applications, Narosa Publications 2009.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C628**	**Satellite Communications (PE-II)**	**3**	**0**	**0**	**3**

Prerequisites: *MWOC*

Course objectives*:*

The course objectives of this course are

- *To introduce the working principles and various design aspects of satellite sub-systems.*
- *To get acquinted with the multiple access techniques and the working principle of GPS systems.*

Course Objectives*: After studying this course, the students will be able to*

CO1	*Demonstrate the orbital mechanics.*
CO2	*Design the satellite subsystem.*
CO3	*Estimate the C/N and able to measure the relevant values.*
CO4	*Evaluate the satellite link.*
CO5	*Recall Multiple access concepts and discuss earth station technology*
CO6	*Apply the knowledge of GPS in real time applications.*

Mapping of Course Outcomes with Program Outcomes

CO	**Satellite communications (8C628)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*Demonstrate the orbital mechanics.*	3	3	3	3					3				3	3	
CO2	*Design the satellite subsystem*	2	3	3	3					3				3	3	
CO3	*Estimate the C/N and able to measure the relevant values*	3	2	2	3					3				2	3	

CO4	*Evaluate the satellite link.*	3	2	3	3					3				3	3	
CO5	*Recall Multiple access concepts and discuss earth station technology*	3	3	3	2					3				3	2	
CO6	*Apply the knowledge of GPS in real time applications*	2	3	3	2					3				3	3	
CO	overall	3	3	3	3					3				3	3	

Syllabus Content

UNIT-I

INTRODUCTION

Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Kepler's laws of orbital motion. Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

ORBITAL MECHANICS AND LAUNCHERS

Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems' performance

UNIT-II

SATELLITE SUBSYSTEMS

Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.

UNIT-III

SATELLITE LINK DESIGN

Basic transmission theory, system noise temperature and G/T ratio, Design of down link and up link.

UNIT-IV

MULTIPLE ACCESS

Frequency division multiple access (FDMA) Intermediation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA. Onboard processing, DAMA, Code Division Multiple access (CDMA),Spread Spectrum transmission and reception.

Applications: Design of a Remote sensing satellite in IRS-4.

UNIT-V

EARTH STATION TECHNOLOGY

Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

Low Earth Orbit And Geo-Stationary Satellite Systems: Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations.

UNIT VI

SATELLITE NAVIGATION & THE GLOBAL POSITIONING SYSTEM

Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

TEXT BOOKS

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, *Satellite Communications* – WSE, Wiley Publications, 2nd Edition, 2003.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, *Satellite Communications Engineering* –2nd Edition, Pearson Publications, 2003.

REFERENCES

1. M. Richharia, *Satellite Communications Design Principles* – BS Publications, 2nd Edition, 2003.
2. D.C Agarwal, *Satellite Communication* - Khanna Publications, 5th Ed.
3. 3K.N. Raja Rao, . *Fundamentals of Satellite Communications* – PHI, 2004
4. Dennis Roddy, *Satellite Communications* – McGraw Hill, 2nd Edition.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8CC51**	**Electronics and Instrumentation(OE-I)**	**2**	**0**	**0**	**2**

Prerequisite: Fundamental concepts of Network Theory and Electronic Circuits.

Course Objectives:

This course aims to:

1. Explain basic concepts, definitions and error analysis in measurement.
2. Identify the details of instrumentation and devices intended for a particular application.
3. Elaborate discussion about the importance of signal display devices and analyzers in measurement and

describe the various bridge configurations and their applications.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Define the characteristics and analyze the errors of measurement systems.
2. Select the appropriate passive or active transducers for measurement of physical phenomenon.
3. Relate and apply the appropriate measuring techniques to real time applications.
4. Interpret the usage of DVM, Spectrum Analyzer and DSO instruments for appropriate measurements.
5. Develop an understanding of construction and working of different AC and DC bridges and their applications.

CO	**Electronics and Instrumentation (8CC51)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Define the characteristics and analyze the errors of measurement systems	3	2	2	2	2								2	2	
CO2	Select the appropriate passive or active transducers for measurement of physical phenomenon	3	2	2	2	2								2	2	

CO3	Relate and apply the appropriate measuring techniques to real time applications	3	2	2	2	2								2	2	
CO4	Interpret the usage of DVM, Spectrum Analyzer and DSO instruments for appropriate measurements	3	2	2	2	2								2	2	
CO5	Develop an understanding of construction and working of different AC and DC bridges and their applications	3	2	2	2	2								2	2	
CO	Overall	3	2	2	2	2								2	2	

UNIT– I

Error - Absolute error, Relative error and Accuracy, Precision - conformity and significant figures, limiting errors, Propagation of errors, Errors in measurement-gross, systematic and random errors,

UNIT – II

Loading effect, Statistical analysis of measurement data and probable error, Resolution, Sensitivity, Calibration. Classification of transducers, Strain gauges - gauge factor, bonded, un-bonded and semiconductor stain gauges

UNIT – III

LVDT - principle, construction and displacement measurement, Capacitive transducer - principle andthicknessmeasurement, Piezo-electric transducer and different modes of operation, Photo-electric transducers.

UNIT – IV

Characteristics, pressure, power and intensity levels of sound, Microphones, Temperature measurement - resistance wire thermometers, semiconductor thermometers and thermocouples.

UNIT – V

DVMs- ramp, dual-slope integration, integrating and successive-approximation types, digit, resolution, sensitivity and general specifications, Spectrum analyzers, Digital storage oscilloscope, Introduction to Virtual Instrumentation

UNIT – VI

Introduction to Bridges, DC Bridges - Wheatstone's bridge, Kelvin's bridge, AC bridges - introduction, general balance equation for four arm bridge, capacitance comparison bridge, inductance comparison bridge, Maxwell's bridge, Wien'sbridge, Wagner's earth connection.

Text Books:

1. Albert D. Helfric, and William D. Cooper, "Modern Electronic Instrumentation and Measurement
Techniques", PHI, 2010.
2. D V S Murthy, "Transducers and Instrumentation", 2nd Edition, PHI, 2013.
3. Nakra B.C, and Chaudhry K.K., "Instrumentation, Measurement and Analysis", 3rdEdition, TMH, 2013.

Reference Books:

1. David A. Bell, "Electronic Instrumentation and Measurements", 2nd Edition, PHI, 2003.
2. H S Kalsi, "Electronic Instrumentation", 3rdEdition, TMH, 2011.
3. A.K.Sawhney, "Electrical & Electronic Measurement and Instruments", DhanpatRai& Co. Publications, 2005.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8CC56**	**Fundamentals of digital circuits & Microprocessors**	**2**	**0**	**0**	**2**

Course objectives: To develop the skills for understanding the design of digital circuits, learn programming skills for 8086 Microprocessor and interfacing peripherals to it.

Course outcomes*:*

1. *To understand number systems and apply the rules of Boolean algebra to simplify Boolean expressions using theorems and K-maps.*
2. *To design combinational circuits such as full adders, multiplexers, decoders, encoders. Code converters etc.*
3. *To design basic memory units (latches and flip-flops) and sequential circuits*
4. *To understand Architecture of 8086 and analyzing in single mode and in multi processor mode.*
5. *To understand instructions of 8086 and to write Assembly Language Programs*
6. *To interface I/0 devices with 8086.*

CO	**Fundamentals of digital circuits & Microprocessors(8CC56)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*To understand number systems and apply the rules of Boolean algebra to simplify Boolean expressions using theorems and K-maps.*	3	2	2	2	2								2	2	
CO2	*To design combinational circuits such as full adders, multiplexers, decoders, encoders. Code converterset*	3	2	2	2	2								2	2	

	c															
CO3	*To design basic memory units (latches and flip-flops) and sequential circuits*	3	2	2	2	2							2	2		
CO4	*To understand Architecture of 8086 and analyzing in single mode and in multi processor mode.*	3	2	2	2	2							2	2		
CO5	*To understand instructions of 8086 and to write Assembly Language Programs .*	3	2	2	2	2							2	2		
CO6	*To understand instructions of 8086 and to write Assembly Language Programs*	3	2	2	2	2							2	2		
CO	Overall	3	2	2	2	2							2	2		

UNIT – I

Number System and Boolean Algebra: Binary, decimal, octal, hexa decimal, weighted and un-weighted codes. Axiomatic definition of Boolean algebra, Binary operators, postulates of and theorems.Boolean addition, subtraction, 1's complement, 2's complement. Switching functions, Canonical forms and Standard forms, Simplification of switching functions using theorems. K-map representation, simplification of logic functions using K-map.

UNIT - II

Combinational Logic Design: Single output and multiple output combinational logic circuit design, Binary adders/subtractors, Encoder, Decoder, Multiplexer, Demultiplexer, Parity bit generator, Code-converters.

UNIT - III

Sequential circuits: Classification of sequential circuits, the clocked SR flip flop, J- K, T and D-types flip flops, triggering mechanism of flip-flops, flip-flop conversion, introduction to counters and registers

UNIT - IV

Architecture of 8086 Microprocessor: Memory segmentation, BIU and E.U General Purpose registers, 8086 flag register and function of 8086 Flags, Pin diagram of 8086-Minimum mode and maximum mode of operation.

UNIT – V

Instruction set of 8086: Addressing modes of 8086, Assembly directives,Simple programs. Assembly language programs: involving logical, Branch & Call instructions, sorting.

UNIT - VI

Interfacing with 8086: Interfacing with RAM, ROM, 8255 PPI – Interfacing with key board, ADC and DAC Stepper Motor.

Text Books:

1. Morris Mano-,Digital design –PHI, 2nd Edition.
2. ZviKohavi and Niraj K Jha -Switching & Finite Automata theory – Cambridge, 3rd Edition.
3. Microprocessors and interfacing – Douglas V. Hall, TMH, 2nd Edition, 1999.
4. Advanced microprocessor & Peripherals - A.K.Ray&K.M.Bhurchandi, TMH, 2000.

References:

1. Fletcher -An Engineering Approach to Digital Design – PHI.
2. Fundamentals of Logic Design, Roth, Kenny, Seventh Edition, Cengage Learning
3. R.P.Jain-Switching Theory and Logic Design- TMH Edition,2003.
4. CVS Rao -Switching Theory and Logic Design –Pearson Education, 2005
5. Micro computer systems, The 8086/8088 Family Architecture, Programming and Design – Y.Liu and G.A. Gibson, PHI, 2nd Edition.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C678**	**Antenna Simulation Lab**	**0**	**0**	**4**	**2**

Prerequisites:

AWP, EMTL

Course Objectives:

The objectives of this lab is

- *To perform laboratory experiments on designing of various antennas and measure the performance parameters.*

Course Outcomes*: After studying this laboratory course, the students will be able to*

CO1	*Understand the design of dipole antenna for various frequencies.*
CO2	*Understand the design of monopole antenna for variation in radius of the wire*
CO3	*Design of Microstrip patch antenna in different shapes*
CO4	*Understand the design of standard horn antenna*
CO5	*Analyze the characteristics of yagi-uda antenna*
CO6	*Verify the radiation pattern of different types of antenna*

Mapping of Course Outcomes with Program Outcomes

CO	**Antenna Simulation Lab (8C678)**	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	*Understand the design of dipole antenna for various frequencies.*	3	3	3	3	3				3				3	2	
CO2	*Understand the design of monopole antenna for variation in radius of the wire*	3	3	3	3	3				3				3	2	
CO3	*Design of Microstrip patch antenna in different shapes*	3	3	3	3	3				3				3	2	
CO4	*Understand the design of standard horn antenna*		2	2	2	2				2				2	1	

CO5	*Analyze the characteristics of yagi-uda antenna*	2	2	2	2	2				2				2	1		
CO6	*Verify the radiation pattern of different types of antenna*	2	2	2	2	2				2				2	1		
CO		2	2	2	2	2				2				2	1		

Syllabus content:

1. Dipole antenna
2. Dipole antenna with lambda variation
3. Monopole antenna
4. Monopole antenna with wire radius variation
5. Microstrip rectangular patch antenna
6. Microstrip circular patch antenna
7. Horn antenna
8. Yagi-uda antenna
9. Radiation pattern measurement of dipole antenna
10. Radiation pattern measurement of patch antenna
11. Radiation pattern measurement of yagi-uda antenna
12. Radiation pattern of broad side antenna array
13. Radiation pattern of End fire antenna array

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8EC65**	**Computer Networks Lab**	**0**	**0**	**2**	**1**

Course Objectives:

To provide an understanding of the design concepts of framing Error Detection & correction, Routing, Congestion concepts and Network tools.

Course Outcomes:

At the end of this course, the student will be able to

1. Implement and analyze framing methods of data link layer.
2. Implement and analyze framing methods of data link layer.
3. Illustrate and implement error detection & correction techniques.
4. Implement different Routing Algorithm.
5. Understand basic Network Commands.
6. Use of Wireshark and NS-2 tools

CO	**Computer Networks Lab (8EC65)**	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	Implement and analyze framing methods of data link layer		2	2	2	2								2	2	
CO2	Implement and analyze framing methods of data link layer.		2	2	2	2								2	2	
CO3	Illustrate and implement error detection & correction techniques	2	2	2	2	2								2	2	
CO4	Implement different Routing Algorithm	2	2	2	2	2								2	2	
CO5	Understand basic Network Commands		2	2	2	2								2	2	

CO6	Use of Wireshark and NS-2 tools		2	2	2	2								2	2	
CO		1	2	2	2	2								2	2	

Computer Networks Lab Exercises:

1. Implement the data link layer framing methods such as

   a) Character / Byte stuffing

   b) Bit stuffing.

2. Implement on a data set of characters the three CRC polynomials

   a) CRC 12

   b) CRC 16

   c) CRC CCITT.

3. Implement Hamming code for error detection and error correction

4. Implement Dijkstra's algorithm to compute the shortest path through a graph.

5. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table for each node using distance vector routing algorithm.

6. Implement Congestion control using Leaky-Bucket Algorithm

7. Execute the basic Networking Commands

   i. Arp ii. Hostname

   iii. ipconfig iv. ipconfig/all

   v. Ipconfig/renew vi. Ipconfig/release

   Vii. Ipconfig/flushdns viii. Pathping

   ix. Ping x. Route

   xi. tracert

<u>Beyond Syllabus</u>

1. Installation of NS-2

2. Demonstration of NS-2

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8CC79**	**Digital Signal Processing Lab**	**0**	**0**	**4**	**2**

Prerequisites:*SS,PTSP, Basic Simulation Lab*

Course Objectives*: After completing this course, the students will have demonstrated*

CO1	*To Understand the frequency response of a given systems*
CO2	*Design of FIR & Butterworth and chebyshev approximations and converting them to IIR filters*
CO3	*Transforming an analog filter to its digital equivalent*
CO4	*Sampling rate conversion Interpolation and decimation*
CO5	*An ability to use TMS320c6713 for different algorithms*

Mapping of Course Outcomes with Program Outcomes

CO	**Digital Signal Processing lab (8CC79)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
CO1	*To Understand the frequency response of a given systems*		3	2		3				2			3	2	2	
CO2	*Design of FIR & Butterworth and chebyshev approximations and converting them to IIR filters*		2							2				2	2	
CO3	Transforming an analog filter to its digital equivalent		3	3		3				2				2	2	
CO4	Sampling rate conversion Interpolation and decimation			3	2	3				2				2	2	
CO5	An ability to use TMS320c6713 for different algorithms			2	2	3				2			3	2	2	
CO	Overall		3	3	2	3				2			3	2	2	

Syllabus Content

Tools to be used: MATLAB, CC Studio, TMS320C6713

1. Impulse response of first order and second order systems.
2. Program to find frequency response of LP/HP filters (difference equation/ transfer function).
3. To find Circular convolution of given sequence with and without built in function.
4. To find the DFT/IDFT, FFT of given DT signals with and without built in functions.

5. To find Power Spectral Density of a sequence.
6. To implement IIR filter (LP/HP/BP)
    a) Butterworth filter
    b) Chebyshev Type-I and Type-II filters
7. To design FIR filter (LP/HP) using windowing technique
    a) Using rectangular window
    b) Using triangular window
    c) Using Kaiser Window
8. Down sampling and up sampling of given sequence by specified factor.
9. Conversion of Analog filter to Digital Filter.
    a) impulse invariant transformation
    b) bilinear transformation
10. Generation of DTMF signals
11. Noise removal: Add noise above 3 KHz and then remove, interference suppression using 400 Hz tone.

The following experiments are to be implemented using CCS

1. Study the architecture of DSP chips-TMS 320C 5X/6X Instructions
2. To find Linear convolution of given sequence.
3. To find Circular convolution of given sequence
4. To find the DFT & FFT of given sequence
5. Generation of DTMF Signals
6. Implementation of Decimation Process & Interpolation Process.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C692**	**Group Project**	**0**	**0**	**2**	**1**

Pre-Requisites: All Courses till this semester

*After studying this course, the students will be able to***:**

i. *use the concepts, in conceptualizing, designing and executing the modules of the projects.*
ii. *exhibit the interest in learning the modern tools and technologies.*
iii. *inculcate an enthusiasm to use the creative ideas to build the innovative projects*
iv. *improve communicative skills and team working skills*

Mapping of Course Outcomes with Program Outcomes

CO	**Group Project (8C692)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Use the concepts, in conceptualizing, designing and executing the modules of the projects	3	3	3										3		3
CO2	Exhibit the interest in learning the modern tools and technologies.		2	3		3							3		3	
CO3	Inculcate an enthusiasm to use the creative ideas to build the innovative projects		2	3	2		3	3					3			3
CO4	Improve communicative skills and team working skills									3	2	2				
CO	Overall	3	2	3	2	3	3	3		3	2	2	3	3	3	3

A group project shall be carried out by a group of students consisting of 2 to 3 in number in third year 2nd semester. This work shall be carried out under the guidance of the teacher and shall involve design, fabrication, software development or any other significant activity. This can be of interdisciplinary nature also.

There will be 100 marks in total with 30 marks of internal evaluation and 70 marks of external

The **internal evaluation** shall consist of:

Day to day work	:	15 marks
Report	:	05 marks
Demonstration / presentation	:	10 marks
		30 marks
End examination	:	70 Marks.

External Evaluation of the project (viva-voce) shall be conducted by a committee appointed by the Chief Superintendent. The end examination will be carried out by a committee consisting of an external examiner, head of the department, a senior faculty member and the supervisor.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II	**8C668**	**Comprehensive Viva Voce**	**1**	**0**	**0**	**1**

Pre-Requisites: All Courses till this semester

On completion:

1. Comprehend the concepts in the core and elective courses.
2. Exhibit technical knowledge to face interviews.
3. Exhibit lifelong Learning skills for higher education and to pursue Professional practice.

Mapping of Course Outcomes with Program Outcomes

CO	**Comprehensive Viva Voce (8C668)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Assess the relevant courses they have undergone till the completion of that academic year. Comprehend the concepts in the core subjects and the elective subjects, to make them ready to face technical interviews which improve their employability skills. They are asked to comprehend the concepts in the core subjects and the elective subjects, to make them ready to face technical interviews which improve their employability skills. Assessment is done in the relevant courses they have undergone till the completion of that academic year.	3	2								2			3		
CO	Overall	3	2								2			3		

Comprehensive Viva Voce will be conducted in second year second semester for 100 marks. Out of 100 marks 30 marks are evaluated internally and 70 marks for external evaluation.

Internal:

Comprehensive Viva Voce is conducted twice in a semester and evaluated for 30 marks each and average will be considered for internal.

Internal Examination : 30 Marks

End examination : 70 Marks.

External Evaluation of the project (viva-voce) shall be conducted by a committee appointed by the Chief Superintendent. The end examination will be carried out by a committee consisting of an external examiner, head of the department, and subject experts.

Syllabus for B. Tech (E.C.E.) III Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
III - II		**Summer Industry Internship - II: Evaluation will be done along with 4-1 courses**				

Course Objective:

The students undergo industrial training so that he/she become industry-ready.

Course Outcomes:

At the end of the training, the student is able to

1. Select the real-time problem in the industry.
2. Analyze the requirements with respect to the problem statement
3. Design the optimal solution for the problem.
4. Implement the solution using the appropriate modern tools.
5. Present and submit the report

Mapping of Course Outcomes with Program Outcomes

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CO	**Summer Industry Internship - II**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Select the real-time problem in the industry.	2	2	2	2	3				3				2	2	
CO2	Analyze the requirements with respect to the problem statement		3	2	2	3				3				2	2	
CO3	Design the optimal solution for the problem.			3	2	3				3				1	2	
CO4	Implement the solution using the apropriate modern tools	2	2	2	3	3				3				2	3	
CO5	Present and submit the report	3	3	3	3	3				3				3	3	
CO	Overall					3				3				2	2	

Student shall carryout the project in industry during summer vacation for 3-6 weeks. There is internal and external Evaluation. Internal Evaluation carries 30 marks and external Evaluation carries 70 marks, Total 100 marks. Evaluation is carried out in B.Tech IV year I semester (7^{th} Semester).

IV– I

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C714**	**Internet of Things and Applications**	**2**	**1**	**0**	**3**

Course Objectives: The student will learn about

1. *Terminology, technology and applications of IoT*
2. *Sensors and Actuators required to build an IoT system*
3. *Necessary Wireless Networks and protocols*
4. *Raspberry PI3 as a hardware platform for IoT sensor interfacing and*
5. *Various IoT application as case studies*

Course Outcomes: After completing this course, student shall be able to

1. *Build a simple IoT System for a given application*
2. *Describe and utilize necessary protocols for communication and management of an IoT system*
3. *Design, Develop and Illustrate IoT applications using Raspberry PI platform and Python Scripting*

Mapping of Course Outcomes with Program Outcomes

CO	Internet of Things and Applications(**8 C714)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Able to learn Sensors and Actuators required to build an IoT system				1	2							2	2	2	2
CO2	Build a simple IoT System for a given application			2		3							3	2	3	3
CO3	Describe and utilize necessary protocols for communication and management of an IoT system		2										2	2		2
CO4	Design, Develop and Illustrate IoT applications using Raspberry PI platform and Python Scripting			2		3							3	2	3	3
CO5	Able to understand the design methodology of IOT application development			2									3	2		3
CO6	Design of case studies using IOT for Manufacturing, health care,			2	2	3	2						3	2	3	3

	Agriculture and entertainment.															
CO	Overall		2	2	2	3	2						3	2	3	3

Unit – 1- Introduction to IoT

Part A - Introduction

IoT terms and basic definitions, IoTvs M2M, Characteristics of IoT, IoT Eco-System, IoT applications and marketplace and IoT Reference Model

Part B – Sensor and Actuators

Introduction to transducers, sensors and actuators, Sensor – classification and types, Actuators – Classification and types.

Unit 2–Embedded Platform for IoT – Rpi 3

Embedded Platform brief introduction - Ardiuno, Raspberry Pi 3 and Intel Galileo

RPI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

Unit 3 – IoT Wireless Networks

Introduction to WSN and its architecture – Network topologies, Issues, Challenges and Security, WSN Technologies and its application - WiFi, Bluetooth, Zigbee, LoRa.

Unit 4 – IoT Protocol

Characteristics and Architecture of MQTT, XMP, DDS, AMQP, COAP and REST and their comparison

Unit 5 - IoT Design Methodology

Process and requirement, Level Specification, Domain model and service specification, IoT application Development

Unit 6: Case Studies Illustrating IoT Application

Home Automation – Smart Lighting, Home intrusion detection, Cities – Smart parking, Environment – Weather monitoring system, Weather reporting bot, Air pollution monitoring, Forest fire detection, Agriculture – Smart irrigation,

Text Books

1. Internet of Things, Author(s): Srinivasa K.G. | Siddesh G.M. | HanumanthaRaju R, ISBN: 9789386858955, Cengage Publications, 2018
2. Internet of Things A Hands on Approach by ArshdeepBahga, Vijay Madisetti Publisher Universities Press. ISBN – 978 81 7371 954 7

Reference books

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
4. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118- 47347-4, Willy Publications

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C715**	**Advanced Communications and Networks**	**3**	**0**	**0**	**3**

Prerequisites: Signals and Systems, Communication Theory or equivalent

After studying this course, the students will be able to

1. *wireless communication systems and Modern wireless communication systems with examples.*
2. *Characterise Multiple Access Techniques for Wireless Communication and calculate capacity of cellular systems..*
3. *Explain Traffic routing in wireless networks, Wireless data services, Common channel signaling*
4. *Describe about Mobile IP And Wireless Access Protocol.*
5. *Develop different Wireless LAN protocols.*
6. *Define About Fundamentals Of 3G Services, Its Protocols And Applications.*

CO	**Advanced Communications and Networks (8C715)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*Explain wireless communication systems and Modern wireless communication systems with examples*		2											3		
CO2	*Characterise Multiple Access Techniques for Wireless Communication and calculate capacity of cellular systems.*		3			1								2	1	
CO3	*Explain Traffic routing in wireless networks, Wireless data services, Common channel signaling*		2		1									2		

CO4	*Describe about Mobile IP And Wireless Access Protocol*		2											2		
CO5	*Develop different Wireless LAN protocols*		3	2	1									2		1
CO6	*Define About Fundamentals Of 3G Services, Its Protocols And Applications.*		2	2	1		1									1
CO	Overall		2	2	1	1	1							2	1	1

Unit-I:

Spread Spectrum Communications:–Spreading sequences- Properties of Spreading Sequences,Pseudo- noise sequence, Gold sequences, Kasami sequences, Walsh Sequences, Orthogonal Variable Spreading Factor Sequences, Barker Sequence, Complementary Codes

Digital Modulation DQPSK ,8PSK, 16PSK, 8QAM, 16QAM,

Direct sequence spread spectrum:

DS-CDMA Model, Conventional receiver, Rake Receiver ,Synchronization in CDMA, Power Control, Soft handoff, Multiuser detection – Optimum multiuser,detector, Liner multiuser detection.

Unit-II:

Wireless Networking: Introduction, Differences between wireless and fixed telephone networks,Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signalling, ISDN, SS7.
Applications: Ethernet

Unit-III

Mobile IP And Wireless Access Protocol: Mobile IP: IP Packet Delivery, Agent Discovery, Tunneling And Encapsulation, IPV6-Network Layer In The Internet- Mobile IP Session Initiation Protocol WAP Architecture-overview, WML scripts, WAP service, WAP session protocol, Wireless transaction, Wireless datagram protocol.

Unit-IV:.

Wireless LANs: Introduction, Fundamentals of WLANs, Network Architecture, IEEE802.11standards, WiFi Protocols – 802.11b, 802.11g, 802.11a, 802.11n, 802.11ac; Frequency allocation - 802.11b, 802.11g, 802.11a; Modulation and coding schemes - 802.11b, 802.11g, 802.11a, 802.11n; Security, Hot spots, Virtual private networks, HIPERLAN standard.

Unit-V:

Wireless PANs/IEEE 802.15x: Introduction to IEEE 802.15x Technologies: Wireless PAN Applications and Architecture, IEEE 802.15.1 Physical Layer Details, Bluetooth Link Controllers Basics, Bluetooth Link.

Broad Band Wireless MANs/IEEE 802.16x: Introduction to WMAN/IEEE 802.16x Technology, IEEE 802.16Wireless MANs, IEEE 802.16 MAC Layer Details

Unit-VI:Orthogonal Frequency Division Multiplexing and MIMO System

Basic Principles of Orthogonality, Single vs Multicarrier Systems, OFDM Block Diagram and Its Explanation, FDM Signal Mathematical Representation, Selection parameter for ModulationPulse shaping in OFDM, Space DiversityandSystem,MIMO Based System Architecture, Long-Term Evolution:, LTE Architecture, Enhanced Node B, Core network, Radio channel components, TD-LTE,VoLTE.

TEXT BOOKS:

1. Data Communication and Computer Networking - B. A.Forouzan, 3rd ed., 2008, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5 ed., 2008, PEI.

3.Wireless Communications by S.Rappaport.
4.Wireless Networks by Clint Smith and Daniel Collins

REFERENCES:

1. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
2. Data and Computer Communications - William Stallings, 8th ed., 2007, PHI.
3. Data Communication and Tele Processing Systems - T. Housely, 2nd Edition, 2008, BSP.
4. Data Communications and Computer Networks- Brijendra Singh, 2nd ed., 2005, PHI.

5.Telecommunication System Engineering – Roger L. Freeman, 4/ed., Wiley-Interscience, John Wiley & Sons, 2004.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C716**	**Intellectual Property Rights**	**1**	**0**	**0**	**1**

Course Objective:

This course is intended to impart awareness on intellectual property rights and various regulatory issues related to IPR

Course Outcomes:

CO1	Demonstrate a breadth of knowledge in Intellectual property
CO2	Overview of Patents, Searching ,filling and drafting of Patents
CO3	Overview of copyright & GI .
CO4	Overview of Trade Mark & Trade Secret,
CO5	Overview of Integrated Circuit and Industrial Design.
CO6	Knowledge about different national and international : Conventions and Treaties Governing the IPRs

CO	**Intellectual Property Rights(8C716)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Demonstrate a breadth of knowledge in Intellectual property						3		3							
CO2	Overview of Patents, Searching ,filling and drafting of Patents						3									
CO3	Overview of copyright & GI .						2		3							
CO4	Overview of Trade Mark & Trade Secret,						3		3							
CO5	Overview of Integrated Circuit and Industrial Design						3		3							
CO6	Knowledge about different national and international : Conventions and Treaties Governing the IPRs						3		2							
CO	Overall						3		3							

Unit I: Introduction to IPR: Discovery, Invention, Creativity, Innovation, History & Significance of IPR, Overview of IPR -Patent, Copyright, Trade Mark, Trade Secret , GI, Industrial Design & Integrated Circuit, Non-patentable criteria

Unit II: Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Patent infringement- Case studies- Apple Vs Samsung, Enfish LLC Vs Microsoft, Overview of Patent search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law

Unit III: Copyrights and Geographical Indications: Types of Copyrights, Procedure for filing, copyright infringement, Copyright Law, Geographical Indications -TirupatiLaddu , Darjeeling Tea, Basmati rice

Unit IV: Trademark and Trade secrets: Trade Marks –Commercial importance, protection, registration, Case Studies- Sabena and Subena, Castrol Vs Pentagon, Trade Secrets- Case Studies- Kentucky Fried Chicken (KFC), Coca-Cola

Unit V: Protection of Industrial Designs & Integrated Circuits: Industrial Designs – Scope, protection, filing, infringement; Integrated Circuits & Layout design, Semiconductors, Unfair competition, Designs Act.

Unit VI: International Conventions & Treaties: Overview of WTO, GATT, TRIPS, WIPO, Berne Convention, Rome convention, Paris Convention, Patent Cooperation Treaty (PCT), Madrid Protocol, Budapest Treaty, Hague agreement

Text Book:

1. Deborah E. Bouchoux, Intellectual Property for Paralegals – The law of Trademarks, Copyrights, Patents & Trade secrets, 3rd Edition, Cengage learning, 2012
2. N.S. Gopalakrishnan& T.G. Agitha, Principles of Intellectual Property, Eastern Book Company, Lucknow, 2009.

References

1. M. M. S. Karki , Intellectual Property Rights: Basic Concepts, Atlantic Publishers, 2009
2. NeerajPandey&KhushdeepDharni, Intellectual Property Rights, Phi Learning Pvt. Ltd
3. AjitParulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd, 2006.
4. B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
5. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C729**	**VLSI Physical Design (PE-III)**	**3**	**0**	**0**	**3**

This course is introduced to help VLSI career aspirants in the field of VLSI Physical Design. It coverscomplete details from VLSI design specification till VLSI IC physical design flow, helps to acquiresufficient skills as needed by Industry.
Course modules cover industry needed in depth knowledge to handle challenges in VLSI Back EndFlow. Students will learn complete knowledge from netlist to GDS2, by working on advancedlower nanometer technology nodes.
The course will benefit VLSI Engineers seeking to enter into VLSI backend design job. In this role engineers will be working for Block & full chip level Physical Design Implementation.
The main focus of the course is to make students understand physical design of IC from netlistthrough GDSII, creating physical layout representation for each logical functions within blocks toenable IC fabrication process. Through this course emphasis will be given on learning throughpractical backed by theoretical concepts taught during class room & extended lab sessions.

Prerequisite Courses - Digital Logic Design, VLSI and Digital Design Through Verilog

CAD Tool - Cadence - Innovus, Tempus, Genus, Xcelium, and Others..

Units 1 - Introduction

Overview of ASIC/SOC design flow, Digital Design Concepts and Physical Design flow setup. Review of ASIC fundamentals & fabrication methodologies. Design Strategies - a) Simulation and synthesis issues, b) RTL design strategies, c) Static timing analysis.

Units 2 - Design Standard Cell Libraries

Design of combinational circuits, Implementation and analysis of combinational circuits like, adders, comparator, multiplier etc., Design of sequential circuits (Synchronous and Asynchronus), Design of Finite State Machines (FSM).
Design data preparation, process technologies and standard cell libraries. Understanding of standard cell technology parameters, netlist generation and technology mapping. Reviewing timing constraints and IO constraints. Low power and low area design concepts
Exercises on Cadence Tool - Writing RTL for ASIC design flow, Understand ASIC Design Flow with 4-bit Counter Design

Units 3 - Static Timing Analysis

Introduction to STA, Comparison with DTA, Timing Path and Constraints, Different types of clocks,
Clock domain and Variations, Clock Distribution Networks, How to fix timing failure, Introductions
to timing static and dynamic hazards, Path delay, Gate delay, Metastability states, Sequential timing delays like set-up time, hold time, Maximum frequency, violations, slew, slack, Delay

analysis, Sequential logic pad to set up, pad to pad, clk to next Reg, Reg to o/p and Reg to Reg.

violations wrt sequential circuit.

Units 4 - Design Floor Planning - Power Planning

Design plan for hierarchical and flat design implementation, better partition techniques and flowsetup. Special cells and IO cells usage planning, congestion removal techniques and implementation constraint setup. Understanding various floor planning techniques, setting up guidelines for better floor planning and meeting design goals. IO PAD placement planning, powerplanning. Adding power rings and power mesh.

Units 5 - Clock Tree Synthesis and Routing

Implementation of clock tree in placed design, understanding various aspects of timing parameters like clock setup/hold, skew and latency issues, Adding buffers in clock tree and implementing clock tree. Analyzing timing reports after clock tree synthesis and fixing issues. Various types of routing, trial route, special route, global routing and detailed routing. Analyzing routed design checking post routed design issues, DRC checks, timing checks, optimization of routing constraints

Units 6 - Design Checks and Signoff

Doing complete path and module based timing analysis, checking timing optimizer reports, identifying failing paths, fixing issues. Extracting capacitor table values for the design. IR drop andelectro migration analysis. Perform DRC, Logical Equivalence checking, generating detailed timing/power reports, generating power reports. GDS-II generation.

Books

Physical Design Essentials: An ASIC Design Implementation Perspective by *Khosrow Golshan*, ISBN 0-387-36642-3

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C730**	**Embedded System Design using ARM(PE-III)**	**3**	**0**	**0**	**3**

On completion of this course you should be able to:

1. Understand the basic architecture of Embedded System and their classification.
2. Explore the architecture of ARM processor.
3. Understand the addressing modes and data processing instructions of ARM processor.
4. Understand the ARM thumb instruction set and its capabilities.
5. Use both assembly and C language based ARM programming and Explore the memory management techniques in ARM.

Mapping of Course Outcomes with Program Outcomes

CO	**Embedded System Design using ARM (8C730)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Understand the basic architecture of Embedded System and their classification.	3	2	2		1							3	3		
CO2	Explore the architecture of ARM processor	1	3	3						3						
CO3	Understand the addressing modes and data processing instructions of ARM processor	1	2	3	3	3	3			3					3	
CO4	Understand the ARM thumb instruction set and its capabilities	3	2	2		1							3	3		

CO5	Use both assembly and C language based ARM programming	1	2	3						3						
CO6	Explore the memory management techniques in ARM	2		3	3	3	3			3					3	
CO	overall	2	2	3	3	2	3			3			3	3	3	

UNIT-I

Introduction to embedded system:

Embedded system architecture, classifications of embedded systems, challenges and design issues in embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC, fundamentals of VonNeuman/Harvard architectures, types of microcontrollers, selection of microcontrollers.

UNIT –II:

ARM Architecture:

ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families.

UNIT –III:

ARM Programming Model – I:

Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

UNIT –IV:

ARM Programming Model – II:

Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions

UNIT –V:

ARM Programming:

Simple C Programs usingFunction Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, ConditionalExecution and Loops.

UNIT –VI:

Memory Management:

Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation, Access Permissions, Context Switch.

TEXT BOOKS:

1. ARM Systems Developer's Guides- Designing & Optimizing System Software – Andrew N. Sloss, Dominic Symes, Chris Wright, 2008, Elsevier.

REFERENCE BOOKS:

Embedded Microcomputer Systems, Real Time Interfacing – Jonathan W. Valvano – Brookes / Cole, 1999, Thomas Learning.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C731**	**DSP Processors and Architectures(PE-III)**	**3**	**0**	**0**	**3**

Course Objectives:

The objectives of this course are

- To study the architecture of Digital Signal Processors and Interfacing of processor to I/O devices

Course Outcomes: After studying this course, the students will be able to

CO1	Understand the concepts of DFT,FFT digital filters
CO2	Illustrate the concepts of Computational Accuracy in DSP Implementations
CO3	Explain the Architectures for Programmable DSP Devices:
CO4	Explain Programmable Digital Signal Processors
CO5	Distinguish Analog Devices Family of DSP Devices .
CO6	Illustrate Interfacing Memory and I/O Peripherals to Programmable DSP Devices

Mapping of Course Outcomes with Program Outcomes

CO	**DSP Processors and Architectures (8C731)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Understand the concepts of DFT,FFT digital filters	2												2		
CO2	Illustrate the concepts of Computational Accuracy in DSP Implementations	2												2		
CO3	Explain the Architectures for Programmable DSP Devices:		2	2										2		
CO4	Explain Programmable Digital Signal Processors		2	2										2		
CO5	Distinguish Analog Devices Family of DSP Devices .		2	2										2		
CO6	Illustrate Interfacing Memory and I/O Peripherals to Programmabl		2	2										2		

	e DSP Devices															
CO	Overall	2	2	2										2		

UNIT I

Introduction to DSP Processors: Differences between DSP and other μp architectures, their comparison and need for special ASPs, RISC & CISC CPUs .

UNIT II

Overview of DSP processor design: fixed point DSPs– Architecture of TMS 320C 5X, C54X Processors , addressing modes, Assembly instructions, Pipelining and on-chip peripherals. Floating point DSPs: Architecture of TMS 320 – IX.

UNIT III

Data formats, F.P. operations, addressing modes, instructions, pipelining and peripherals.

UNIT IV

DSP interfacing & software development tools: I/O interfacing with A/D converters, PCs, Dual port RAMS, EPGAs,

UNIT V

DSP tools – Assembler, debugger, c-compiler, linker, editor, code composer studio.

UNIT VI

Applications using DSPs adaptive filtering, spectrum analysis, Echo cancellation modems, voice synthesis and recognition. Brief ideas of AD, Motorola DSP CPUs and their comparison with TI CPU S.

SUGGESTED READING:

1. C. Marren& G. Ewess, "A Simple Approach to Digital Signal Processing", WILEY Inter-science, 1996.
2. K. Shin, "DSP Applications with TMS 320 Family", Prentice Hall, 1987.
3. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C732**	**Ad hoc and Wireless Sensor Networks(PE-III)**	**3**	**0**	**0**	**3**

Pre-requisites:

Probability & Stochastic process, Cellular mobile Communications

Course Objectives**:**

This course is intended to impart to the students the principlesof

1. To study about the basics of wireless networks
2. To understand the challenges in wired vs. wireless domain in computer networks.
3. To study about various types of wireless networks, i.e cellular networks, Bluetooth, Ad hoc networks and wireless sensor networks.
4. To study about various network security attacks and key management.

Course Outcome:

Upon completion of this module, students will be able to:

1. Understand the under lying technologies of wireless networks.
2. Specify and identify deficiencies in existing wireless protocols for MAC layer and Network layer, and then go onto formulate new and better protocols.
3. Understand the technology behind the cellular network, installation of base station, Bluetooth etc.
4. To master the concepts of ad hoc networks and the design / performance issues in wireless local area networks and wide area networks.
5. To be familiar with contemporary issues in networking technologies.

Mapping of Course Outcomes with Program Outcomes

CO	**Ad hoc and Wireless Sensor Networks(8C732)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Define characteristics and features of Adhoc Networks	1	3	3	3								3			
CO2	Appreciate the designing of MAC protocol for Adhoc networks	1	1	3	3								3			

CO3	Implement few protocols	1	3	1	3								3			
CO4	Apply security principles for routing	1	3	3	3								3			
CO	overall	1	3	3	3								3			

UNIT 1: Ad Hoc Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet.

UNIT 2: MAC Protocols for Ad Hoc Wireless Networks: Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols. Contention-based protocols.

UNIT 3: Routing Protocols for Ad Hoc Wireless Networks: Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, DSDV, DSR, AODV and ZRP. Differences between Table-driven and On-demand routing protocols.

UNIT 4: Multi-cast routing in Ad Hoc Wireless Networks: Issues in Designing a Multicast Routing Protocol, Classifications of Multicast Routing Protocols, MAODV, ODMRP, Differences between Tree- and Mesh-based protocols.

UNIT 5:
Transport layer in Ad Hoc Wireless Networks: Introduction, Issues in Designing a Transport layer protocol, why does TCP not perform well in Ad-hoc wireless networks.
Security in Ad Hoc Wireless Networks: Introduction, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management.
QoS in Ad-hoc Wireless Networks: Introduction, Issues and challenges in providing QoS in Ad-hoc wireless networks, classifications of QoS solutions.

UNIT 6: Energy Management in Ad Hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks. Classification of Energy Management Schemes. Battery Management Schemes – DLL solutions. Transmission Power Management Schemes – DLL solutions, Network layer solutions, Higher layer solutions.

Text Books:

1. C. S. Ram Murthy, B. S. Manoj, *Ad Hoc Wireless Networks: Architectures and Protocols*, Prentice Hall of India , 2nd Edition, 2005
2. RaminHekmat, *Ad-hoc Networks: Fundamental Properties and Network Topologies*, Springer , 1st Edition, 2006
3. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks Architecture and Protocols, 2nd edition, Pearson Edition, 2007.
4. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000.

References:

1. C. S. Ram Murthy, B. S. Manoj, *Ad Hoc Wireless Networks: Architectures and Protocols*, Prentice Hall of India , 2nd Edition, 2005
2. RaminHekmat, *Ad-hoc Networks: Fundamental Properties and Network Topologies*, Springer, 1st Edition, 2006.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobile ad-hoc networking, Wiley-IEEE press, 2004.
4. Mohammad Ilyas, The handbook of ad-hoc wireless networks, CRC press, 2002.
5. T. Camp, J. Boleng, and V. Davies " A Survey of Mobility Models for Ad-hoc Network" Research, "Wireless Commun, and Mobile Comp. Special Issue on Mobile Ad-hoc Networking Research, Trends and Applications, Vol. 2, no. 5, 2002, pp. 483 – 502.
6. A survey of integrating IP mobility protocols and Mobile Ad-hoc networks, Fekri M. bduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, no: 12007.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C733**	**Computer Vision (PE-III)**	**3**	**0**	**0**	**3**

Prerequisites: Signals & Systems, Linear Algebra, Basics of Probability

Objectives:
Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Upon completion of this course, students should be able to:
1. Recognize and describe both the theoretical and practical aspects of computing with images. Connect issues from Computer Vision to Human Vision
2. Describe the foundation of image formation and image analysis. Understand the basics of 2D and 3D Computer Vision.
3. Become familiar with the major technical approaches involved in computer vision. Describe various methods used for registration, alignment, and matching in images.
4. Get an exposure to advanced concepts leading to object categorization and segmentation in images.
    1. Build computer vision applications.

Course Outcomes: At the end of the course the student will be able to:
CO1 -Development of algorithms and techniques to analyze and interpret the visible world.
CO2 -Apply feature extraction methods for computer processing.
CO3 -Implement pattern recognition algorithms for real world problems CO4 Design of face detectionand recognition algorithms

CO	**Computer Vision (8C733)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Development of algorithms and techniques to analyze and interpret the visible world	1	3	3	3								3			

CO2	Apply feature extraction methods for computer processing.	1	1	3	3								3			
CO3	Implement pattern recognition algorithms for real world problems CO4 Design of face detectionand recognition algorithms	1	3	1	3								3			
CO	overall	1	3	3	3								3			

Detailed Syllabus:

Unit -I

Digital Image Formation and Low-level processing: Overview and State-of-the-art,Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective,etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, HistogramProcessing.

Unit-II

Depth estimation and Multi-camera views: Perspective, Binocular Stereopsis: Camera andEpipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstructionframework; Auto-calibration.

Unit -III

Feature Extraction : Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-SpaceAnalysis- Image Pyramids and Gaussian derivative , Gabor Filters and DWT.

Unit -IV

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut,Mean-Shift, MRFs, Texture Segmentation; Object detection.

Unit -V

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification:Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN.

Unit -VI

Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-TemporalAnalysis, Dynamic Stereo; Motion parameter estimation.

Use Cases on Finger print recognition, Face detection and recognition, medical Diagnosis etc

Text Book(s):

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, PHI Learning 2009.
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Pearson Education.

Reference(s):

1. Shah M., Fundamentals of Computer Vision, 1997.
2. Szeliski R., Computer Vision: Algorithms and Applications, Springer, 2011.
3. Forsyth D. & Ponce J., Computer Vision - A Modern Approach, Prentice Hall, 2002.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C734**	**Radar Systems (PE-III)**	**3**	**0**	**0**	**3**

Prerequisites: *MWE*

Course Objectives*:*

The objectives of this course are

- *Be acquainted with the principle and working of various types of Radar Systems.*
- *To study the principles of phased arrays.*

Course Outcomes*: After studying this course, the students will be able to*

CO1	*Recognise the basics of Radar systems and its applications and its frequencies (Understand)*
CO2	*Differentiate the Radar parameters, how it affects the Range measurement. (Analyse)*
CO3	*Recall the Doppler Effect, and draw backs of CW radars. (Remember)*
CO4	*Discuss the basic concepts of Moving target indicators and evaluate the draw backs of MTI Radars.(Understand)*
CO5	*Differentiate concept of scanning and tracking. (Analyse)*
CO6	*Understand various types of displays and different phased arrays*.

Mapping of Course Outcomes with Program Outcomes

CO	**Radar Systems (8C734)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	POS 3
CO1	Recognise the basics of Radar systems and its applications and its frequencies (Understand)	3			2								3	2	1	2
CO2	Differentiate the Radar parameters, how it affects the Range measurement . (Analyse)	2	3	3	3								3	2	2	2
CO3	Recall the Doppler Effect, and draw backs of CW radars. (Remember)	1	2	3	2								3	2	1	2
CO4	Discuss the basic concepts of Moving target indicators and evaluate the draw backs of MTI	2	2	3	2			3					3	2	1	2

	Radars.(Understand)															
CO5	Differentiate concept of scanning and tracking. (Analyse)			1	3			3					3	1	2	2
CO6	Understand various types of displays and different phased arrays.			3	2								3	2	2	2
CO	Overall	2	2	3	2			3					3	2	2	2

SYLLABUS CONTENT

Unit-I

Nature of Radar, Maximum Range, Radar equation. Block diagram. Radar frequencies and applications. Prediction of Range performance. MDS, Rx Noise, Modified range equation. Related problems.

Unit-II

SNR

Envelope Detectors. Integration of Radar Pulses. RCS of Targets (simple targets-sphere, cone-sphere. PRF and Range Ambiguities. System losses.

Unit-III

CW AND FMCW RADAR:

Doppler Effect. CW Radar, Block diagram, Applications of CW Radar. Rx bandwidth requirements. FM CW Radar, Block diagram and characteristics. FM- CW Altimeter.

UNIT-IV

MTI RADAR

Block diagram of MTI Radar with Power Amplifier and Power Oscillators. Non Coherent MTI Radar. Delay line Cancellers. Double Cancellation. Blind Speeds. Filter Characteristics, Limitations to MTI performance. MTI vs Pulse Doppler Radar. Staggered PRF, Range gated Doppler Filters.

UNIT – V

TRACKING RADARS

Tracking Radars: Sequential lobing. Conical Scan. Mono Pulse tracking Radars. Phase Comparison Mono Pulse.

Matched filter Receiver: MFR Response Characteristics & derivation. Correlation Functions & Cross Correlation Receiver, Efficiency of Matched Filter, Matched Filter with Non White Noise.

UNIT – VI

RADAR RECEIVERS

Noise Figure & Noise Temperature, Radar Displays, Types of Duplexers.

Phased arrays: basic concepts, Beam steering and beam width changes. Series Vs parallel feeds. Applications, Advantages & limitations. ECCM.

TEXT BOOKS

1. Merrill I. Skolnik, *Introduction to Radar Systems,*McGraw-Hill, 2nd Edition, 1981.

REFERENCES

1. Merrill I.Skolnik,*Introduction to Radar systems,McGraw-Hill,3rd* Edition ,2001.
2. Byron Edde, *Radar Principles,Technology,Applications.* Pearson Edition, 2004.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C735**	**Design Verification using System Verilog (PE-IV)**	**3**	**0**	**0**	**3**

Course Description:

This course gives a student an in-depth introduction to the main SystemVerilog enhancements to the Verilog hardware description language (HDL), discusses the benefits of the new features, and demonstrates how design and verification can be more efficient and effective when using SystemVerilog constructs.

The course is broken down into two modules: The Design module examines improvements for RTL design and synthesis; the Verification module explores verification enhancements such as object-oriented design, assertions and randomization.

Prerequisites:

- A working knowledge of Verilog HDL
- The ability to navigate a file system and use a text editor
- A basic understanding of digital hardware design and verification

Course Outcomes

CO1	*Understand the UVM concepts*
CO2	*Explore the class instances and functions*
CO3	*Comprehend the UVM Configurations*
CO4	*Analyzing UVM sequences and Modeling in UVM*
CO5	*Developing Reusable Test benches using UVM and Analyzing the Case studies of Layered test bench for SPI, APB and AXI.*

Mapping of Course Outcomes with Program Outcomes

CO	**Digital Design and Verification with System Verilog (8C735)**	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	*Understand the UVM concepts*	2	2	3	1	2				2	1	1	2	2	2	1
CO2	*Explore the class instances and functions*	1	3	1	1	2				2	1	1	2	3	2	1
CO3	*Comprehend the UVM Configurations*	3	3	1	1	2				2	1	1	2	3	2	1

CO4	*Analyzing UVM sequences and Modeling in UVM*	3	1	1	1	2				2	1	1	2	3	2	1
CO5	*Developing Reusable Test benches using UVM*	1	3	1	1	2				2	1	1	2	1	2	1
CO6	*Analyzing the Case studies of Layered test bench for SPI, APB and AXI.*	1	3	1	1	2				2	1	1	2	3	2	1
CO		2	1	3	1	1	2				2	1	1	2	3	2

Syllabus Contents:

Unit-1 : Introduction to Functional Verification: What is Verification?, What do we verify?, Verification Abstractions, Behavioral level, Transaction level, Functional / RTL level, Gate level, Transaction level; Importance of (Functional) Verification in Chip design life cycle, Verification goals; Overview of various Functional Verification techniques: Simulations, FPGA Prototyping, Emulation, HW/SW Co-verification, Formal Verification, Semiformal Verification, Models of Functional Verification. Black box, White box, Gray box, Verification Hierarchy: Chip-level, Cluster / Subsystem level, IP level, Module / Unit level.

Unit- 2 : Overview of SoC Architectures and Functional Verification Environment: What is an SoC ?, Advantages of SoCs over conventional ASICs?, Typical components of an SoCs, Sample SoC Architectures, Typical SoC based Testbench environment , Stimuli Generators, Hard coded, Direct Stimuli from the environment, Stimuli from the model of the environment (BFMs), Random Stimuli Generation; Predictors: Golden/Reference Model, More Abstract (Functional, Transaction Level), Hardwired response, Response database; Transactors, Monitors , Scoreboards , Coverage Collectors - Coverpoints, Property Checkers - Assertions.

Unit-3 :SystemVerilog Language Concepts: Evolution of SystemVerilog : Differences between Verilog and System Verilog HDL, New features added in System Verilog (New Data type additions, Arrays - Fixed, Packed, Dynamic, Queues, Associated, Structures & Unions, New Operators, New additions to Subroutines, New additions to Procedural statements & Control flow, Concurrency: Fork.join, Fork..join_any, Fork..join_none, Automatic Variables, Interfaces, Program block);

Unit-4 : Object Oriented Programming Concepts-I: Classes : Encapsulating properties & methods, Object memory creation, Working with Object handles, Object copying : Shallow and Deep copy, Object cloning, Object protection, Object variables Vs Class variables: Static keyword, Object Randomization, Randomization Seed - A deep look, Randomization variables, Constraint Block, Weighted Randomization, Controlling Randomization, Solve order, Inline Constraints - with constraints, Object Inheritance, Limitations of Inheritance, Polymorphism and Methods overriding ,

Unit-5: Object Oriented Programming Concepts-II: Virtual Interfaces, Inter thread Synchronization & Communication: Events, Semaphores, Mailboxes, Packages, Assertions, Immediate assertions, Procedural assertions, Temporal operators, Boolean operators, Sequences, Properties, Functional Coverage: Cover points & Bins, Covergroups, Cross coverage, Sampling coverpoints, Calculating functional coverage, Interfacing with C - DPI, Compiler Directives.

Unit-6 : Advanced Testbench Design using SystemVerilog: Introduction to Layered testbench, architecture, Driver, Monitor, Transactor, Generator, Configurations - Device, Transaction, Scoreboard, Reference models, Bus function models.

Textbooks:

1. SystemVerilogFor Verification: A Guide to Learning the Testbench Language Features *by Chris Spear & Greg Tumbush (3rd Edition/5th Edition).*
2. A Practical Guide ForSystemVerilog Assertions by SrikanthVijayaraghavan& MeyyappanRamanathan.

Reference Books:

1. A Practical Guide ForSystemVerilog Assertions by SrikanthVijayaraghavan& MeyyappanRamanathan.
2. Logic Design and verification using System Verilog by Donald Thomas

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C736**	**Embedded Real Time Operating Systems (PE-IV)**	**3**	**0**	**0**	**3**

***Course outcomes**:*

1. Understand the Basic concepts of UNIX operating Systems and files, commands usage.

2.Understand the Real time Systems concepts and classification of Real time systems.

3. Design concepts of scheduling algorithms and its applications.

4. Understand the Interprocess communications and its applications in Real time systems.

5. Understand the Exceptional handling andInterrupts and Timers

6. Understand the case study of RTOS.

Mapping of Course Outcomes with Program Outcomes

CO	**Embedded Real Time operating system (8C736**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	*Understand the Basic concepts of UNIX operating Systems and files, commands usage.*		2										2	2		2
CO2	*Understand the Real time Systems concepts and classification of Real time systems*		2	2	2								2	2		2
CO3	*Design concepts of scheduling algorithms and its applications*		2										2	2		2
CO4	*Understand the Interprocess communications and its applications in Real time systems*		2										2	2		2
CO5	*Understand the Exceptional handling and Interrupts and Timers*		2										2	2		2

CO6	*Understand the case study of RTOS*		2										3	2		3
CO	Overall		2	2	2								2	2		2

UNIT – I

Introduction: Introduction to UNIX/LINUX, Overview of Commands, File I/O,(open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

UNIT - II

Real Time Operating Systems: Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, Tasks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use.

Unit III: Scheduling

Commonly used Approaches to Real Time Scheduling Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs State Systems, Effective release time and Dead lines, Offline Vs Online Scheduling.

UNIT - IV

Inter-process Communication

Inter-process Communication and Synchronization of Processes, Tasks and Threads- Multiple Process. Problem of Sharing data by multiple tasks & routines, Inter-process communication

UNIT - V

Exceptions, Interrupts and Timers: Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

UNIT - VI

Case Studies of RTOS: RT Linux, Micro C/OS-II, Vx Works, Embedded Linux, and Tiny OS.

TEXT BOOK:

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2nd ed., 2008,TMH.
2. Real Time Systems- Jane W. S. Liu- PHI.
3. Real Time Systems- C.M.Krishna, KANG G. Shin, 1996, TMH
4. Qing Li, "Real Time Concepts for Embedded Systems", 2011, Elsevier.

REFERENCE BOOKS:

1. Rajkamal, "Embedded Systems- Architecture, Programming, and Design", 2007, TMH.
2. W. Richard Stevens, Stephan A. Rago, "Advanced UNIX Programming", 2006, 2nd Edition, Pearson.
3. Dr. Craig Hollabaugh, "Embedded Linux: Hardware, Software and Interfacing", 2008, 1st Edition, Pearson.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C737**	**Bio-Medical Signal Processing (PE-IV)**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to:

1. Provide the introduction to and insight into various biomedical signals
2. Provide the understanding of basic and advanced methods to process the biomedical signals using modern tool like MATLAB.
3. Provide the basic understanding of common biomedical instruments

Course Outcomes:

Upon completing this course, students will be able to:

1. Identify the various biomedical signals and their acquisition process
2. Demonstrate the ability to apply the signal processing techniques to analyze the biomedical signals
3. Demonstrate the ability to design the biomedical signal processing algorithm with usage of modern tools

Mapping of Course Outcomes with Program Outcomes

CO	**Bio-Medical Signal Processing (8C737)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Identify the various biomedical signals and their acquisition process	2				2	3									
CO2	Demonstrate the ability to apply the signal processing techniques to analyze the biomedical signals	3				2	3									
CO3	Demonstrate the ability to design the biomedical signal	2				2	3									

	processing algorithm with usage of modern tools.															
CO	overall	2				2	3									

UNIT-I

Basic understanding of biomedical signal, Physiological aspects, Biomedical signal acquisition process and related instruments, Electroencephalogram (EEG), Electrocardiogram (ECG), Electromyogram (EMG), Phonocardiogram (PCG),Photoplethysmography (PPG), Respiratory and Lung sound signals. Basic characteristics and associated pathologies. Biomedical instruments and their working principles.

Case study: Reading the biomedical signals (EEG, ECG, EMG, PCG) in MATLAB.

UNIT-II

Basics of signal processing, review of time and frequency domain signals, Characteristics of Biomedical Signals, Stationary and non-stationary, Linear and non-linear, Chaotic and random signals. Time-series analysis, statistical parameters, Higher order statistics (HOS), Types of distributions, statistical significance tests (Kruskal-Wallis).

Case study: Statistical analysis of biomedical signals in MATLAB environment.

UNIT-III

Revision of Fourier transform (FT), FFT algorithm, and short time Fourier transform (STFT). Limitations of FT and STFT. Time-Frequency (TF) analysis of Biomedical Signals, its need and tools. Basic concepts behind wavelet transform, discrete wavelet transform (DWT), types, advantages and applications.

Case study: Application of FT and STFT, and WT on EEG, ECG, and PCG signals in MATLAB environment.

UNIT-IV

Steps involved in classification of biomedical signals, Preprocessing, Revision of digital filters depending on methods and applications (IIR, FIR, Chebyshev, High pass, low pass, bandpass, notch filters). Noise removal process in biomedical signals with applications.

Case study: Application of digital filters and their effect of noisy signals like ECG (High frequency noise and baseline wander removal), EEG, EMG, PCG, and Lung sound signals in MATLAB environment.

UNIT-V

Feature extraction process, statistical and time domain features, frequency domain features, time-frequency analysis based features. Applications of STFT, DWT for biomedical signal classification. Feature selection using Kruskal-Wallis statistical test. Introduction to basic signal classification process.

Case study: Analysis and feature identification for classifying PCG signals into various heart valve disease categories in MATLAB environment.

UNIT-VI

Biomedical signal processing using signal decomposition method. Empirical mode decomposition (EMD). Introduction to Hilbert-Huang transform (HHT). Advantages, applications, and limitations of EMD method. Introduction to Empirical wavelet transform (EWT). Introduction to variational mode decomposition (VMD).

Text Book:

1. Rangaraj M Rangayyan ,"Biomedical Signal Analysis" –, IEEE Press, 2001
2. Biomedical Digital Signal Processing – Willis J Tomkins, PHI, 1993.
3. Practical Guide for Biomedical Signals Analysis Using Machine Learning Techniques A MATLAB® Based Approac, Elsevier publications • 2019

References:

1. Biomedical Digital Signal Processing Principles and Techniques-D C Reddy, TMH, 2005
2. Biomedical Signal Analysis, 2nd Edition Rangaraj M. Rangayyan ISBN: 978-0-470-91139-6 May 2015 Wiley-IEEE Press.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C738**	**MIMO OFDM System (PE-IV)**	**3**	**0**	**0**	**3**

Pre-requisites:

Probability & Stochastic process, Cellular mobile Communications

Course Objectives:

This course is intended to impart to the students the principlesof

- The fundamental concepts and design principles in "Multiple-Input Multiple-Output" (MIMO) wireless communications –channel capacity, antenna diversity, space-time coding.
- The fundamental concepts in "Orthogonal Frequency-Division Multiplexing" (OFDM) communications – transmission, synchronization, peak-to-average power ratio (PAPR) reduction.
- This fundamental concepts of massive MIMO will present a comprehensive analytical development of the various concepts in massive MIMO and mmWave MIMO technologies for 5G together with practical insights and problem solving.

Course Outcome:

After Learning this course, the student will be able to gain knowledge and understanding of:

CO1. OFDM's transceiver architecture
CO2. The problem of PAPR and how to reduce thePAPR.
CO3. To understand how the OFDM receiver performs synchronization
CO4. Channel modeling and propagation
CO5. MIMO Capacity, space-time coding
CO6. Massive MIMO and mmWave MIMO technologies for 5G

CO	**MIMO OFDM - PE-IV(8C738)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	OFDM's transceiver architecture		2										2	2		2
CO2	The problem of PAPR and how to reduce the PAPR.		2	2									2	2		2
CO3	To understand how the OFDM receiver performs synchronization		2										2	2		2

CO4	Channel modeling and propagation		2	2	2	2							2	2		2

CO5	MIMO Capacity, space-time coding		2	2	2	2							2	2	2	2
CO6	Massive MIMO and mmWave MIMO technologies for 5G												2	2	2	2
CO	Overall		2	2	2	2							2	2	2	2

UNIT 1: Fast Fading Wireless Channel Modeling ,Rayleigh/Ricean Fading Channels ,BER Performance in Fading Channels ,Diversity modeling for Wireless Communications ,BER Performance Improvement with diversity ,Types of Diversity – Frequency, Time, Space.

UNIT 2: OFDM Basics I: Introduction to OFDM Effect- Multicarrier Modulation and Cyclic Prefix-Channel model and SNR performance- OFDM Issues of PAPR- Frequency and Timing Offset Issues.

UNIT 3:Bit Error Rate Analysis: BER Analysis for Space Time Coding, Transmit Beamforming , Receiver Selection Combining, Receiver Equal Combining, Receiver Maximal Ratio Combining.

UNIT 4: Introduction to MIMO, Beam forming Antennas, Diversity: Receive- antenna diversity; Transmit-antenna diversity, MIMO Diversity and applications ,MIMO Channel Capacity of ZF,LMMSE,MMSE .

UNIT 5:Introduction to MIMO: MIMO Channel Capacity-SVD and Eigen modes of the MIMO Channel-MIMO Spatial Multiplexing – BLAST-MIMO Diversity – Alamouti, OSTBC, MRT-MIMO - OFDM.

UNIT 6:Introduction to 5G Wireless Technologies: Key specs and New Techniques for 5G,Introduction to MIMO Wireless Communication Systems ,Channel Estimation for MIMO Systems, Multi-user MIMO Wireless Systems ,Introduction to Massive MIMO Wireless Systems ,Generalized Spatial Modulation, mm Wave MIMO Wireless Systems and Challenges.

Text Books:

1. MIMO-OFDM for LTE, WiFi and WiMAX Li Wang, Ming Jiang, Lajos L. Hanzo, YosefAkhtman Weily2011
2. MIMO-OFDM Wireless Communications with MATLAB Yong SooCho,Jaekwon Kim, Won Young Yang, hung G. Kang John Wiley & Sons(2010)

References:

1. OFDM for Wireless Communications Systems Ramjee Prasad, Artech House Publishers(2004).
2. MIMO Wireless Communications EzioBiglieri Robert Calderbank Anthony Constantinides Andrea Goldsmith Arogya swami Paulraj H. Vincent Cambridge University Press(2007)

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C739**	**Machine Learning (PE-IV)**	**3**	**0**	**0**	**3**

Course Objectives: Learn the basic theory behind machine learning. Understand a range of machine learning algorithms along with their strengths and weaknesses; formulate machine learning techniques corresponding to various applications. Analyze the appropriate machine learning technique for a given problem.

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

1. Formulate machine learning techniques corresponding to various applications.
2. Understand the concepts of Classification and regression models and their applicability
3. Learn the popular clustering algorithms and their parameters
4. Understand basic computational Learning Theory using PAC Learnability and Instance Based Learning
5. Apply machine learning algorithms for solving problems of moderate complexity using Gradient Descent Algorithm, Random Forest Algorithm for Predictive Analytics
6. Understand the Explanation based Learning and Inductive analytical approach to learning.

CO	Machine Learning (**8C739**)	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	Demonstrate fundamental understanding of the history of artificial intelligence(AI) and its foundations	3	2	3		3								3	3	
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	2	2	3		3								3	3	
CO3	Demonstrate awareness and a fundamental understanding	3	2	3		3								3	3	

	of Expert Systems and its applications															
CO4	Demonstrate fundamental understanding of models of machine learning	3	2	2		3								2	3	
CO5	Apply basic principles of Supervised learning	2	2	3		3								3	3	
CO6	Apply basic principles of Unsupervised learning	2	2	3		3								3	3	
CO		2	2	3		3								3	3	

UNIT – I: INTRODUCTION to Learning: Forms of learning, Induction learning, Learning Decision Tree, Statistical learning methods, Learning with complex data, learning with hidden variables, Instance based learning, Reinforcement Learning, Brief Introduction to Pruning and Neural Network Concepts

UNIT II: SUPERVISED LEARNING Linear Models for Regression – Linear Basis Function Models – The Bias – Variance Decomposition – Bayesian, Linear Regression – Bayesian Model Comparison. Linear Models for Classification – Discriminant Functions – Decision Trees – Classification Trees – Regression Trees —– Feed-Forward Network Functions –BackPropagation – Regularization —– Radial Basis Function Networks – Ensemble methods – Bagging – Boosting.

UNIT III: UNSUPERVISED LEARNING Clustering – K-means – Mixtures of Gaussians –EM Algorithm in General – Model Selection for Latent Variable Models – High Dimensional Spaces – The Curse of Dimensionality – Dimensionality Reduction – Factor Analysis – Principal Component Analysis – Probabilistic PCA - Independent Components Analysis.

UNIT IV: ANALYSIS OF LEARNING TECHNIQUES Computational Learning Theory – PAC Learnability – VC Dimension – Mistake Bound model of Learning – Instance Based Learning

UNIT – V: LINEAR REGRESSION Regression Problem Analysis – Mathematical model - Gradient Descent Algorithm – Random Forest Algorithm - Machine Learning for Predictive Analytics

UNIT – VI ANALYTICAL LEARNING Learning with perfect domain theory – Explanation based Learning – Inductive analytical approach to learning – KBANN algorithm – TANGENTPROP algorithm

TEXT BOOK

1. Tom Michel, Machine Learning. McGraw Hill. 1997

REFERENCE BOOKS

1. Trevor Hustie, Robert Tibshirani& Jerome Friedman. The Elements of Statically Learning, Springer Verilag 2001

2. Chris Bishop, Neural Network for, Pattern Recognition, Oxford University Press. 1995

3. EthemAlpaydin, Introduction to Machine Learning", MIT Press, Prentice Hall of India, 2005

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C740**	**Microwave Integrated Circuits (PE-IV)**	**3**	**0**	**0**	**3**

UNIT- I
MIC Technology – Thick film and Thin film technology, Hybrid MICs, Monolithic MIC technology.

UNIT - II
Analysis of stripline and microstripline, Method of conformal Transformation, Characteristic parameters of strip, Microstrip lines, Microstrip Circuit Design, Impedance transformers, Filters, Lumped constant Microstrip circuits.

UNIT - III
Coupled Microstrips and Directional couplers, Even and odd mode analysis, Theory of coupled microstrip, Directional couplers, Calculations for a coupled pair of Microstrips, Branch line couplers.

UNIT - IV
Lumped Elements for MICs, Design and fabrication of lumped elements, circuits using lumped elements.

UNIT - V
Nonreciprocal components for MICs, Microstrip on Ferrimagnetic substrates, Microstrip circulators. Isolators and phase shifters, Design of microstrip circuits – high power and low power circuits.

UNIT - VI

TEXT BOOKS:
1. Gupta KC and Amarjit Singh, “Microwave Integrated circuits”, Wiley Eastern, 1974.
2. Leo Young, “Advances in Microwaves”, Academic Press.

REFERENCE BOOKS:
1. BharathiBhat,and S.K. Koul, “Strip line-like Transmission Lines for Microwave Integrated Circuits”, New Age International, 2007.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8CC52**	**Fundamentals of Communication (OE-II)**	**2**	**0**	**0**	**2**

Course Objectives:

The objective of this subject is to:

1.Introduce the students to communication systems, frequency spectrum ,need for modulation , antenna and measurable parameters.

2. Introduce to various analog and digital modulation schemes.

3. Introduce Radio system, Antenna and Wave propagation.

4. Knowledge in telecommunication systems and Networking

5. Knowledge of satellite communication and Optical communication

6. Cellular and mobile communication, knowledge in wireless technologies.

Course Outcomes: By completing this subject, the student can

- Work on various types of modulations.
- Should be able to use these communication modules in implementation.
- Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.

CO	Fundamentals of Communication (8CC52)	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	Work on various types of modulations.		2		2	2		2						2	1	
CO2	Should be able to use these communication modules in implementation	2	3	3	3	3		2						3	2	
CO3	Will have a basic understanding of various wireless and cellular, mobile and telephone communicati	2	3	3	3	3		2						3	2	

	on systems															
CO			2	3	2	2	2		2					3	2	

UNIT - I

Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels. Fundamentals of antenna and wave propogation.

UNIT - II

Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

UNIT - III

Radio System:

Transmitter fundamentals, Power amplifier, and Typical transmitter circuit.
Super heterodyne receiver, Typical receiver circuit and Noise.

Antenna and Wave Propagation :

Antenna fundamentals, commonly usedantenna ,wave propagation and transmission line.

UNIT - IV

Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.

Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT - V

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT - VI

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.

Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications,4th edition, 2016.
2. Electronic Communications systems, Kennedy, Davis 4e, MC GRAW HILL EDUCATION, 1999

Reference Books:

1. Theodore Rapp port, Wireless Communications - Principles and practice, Prentice Hall, 2002.

2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Introduction to data communications and networking, Wayne Tomasi, Pearson Education, 2005.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C780**	**Internet of Things and Applications Lab**	**0**	**0**	**4**	**2**

Course objectives:

Course outcomes:

CO1: *Able to understand application areas of IOT*
CO2: *Able to understand revolution of internet using Raspberry Pi with python*
CO3: *Able to understand building blocks of IOT and characteristic*

Mapping of Course Outcomes with Program Outcomes

CO	**Internet of Things and Applications Lab (8C780)**	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	*Able to understand application areas of IOT*		2		2	2		2						2	1	
CO2	*Able to understand revolution of internet using Raspberry Pi with python*	2	3	3	3	3		2						3	2	
CO3	*Able to understand building blocks of IOT and characteristic*	2	3	3	3	3		2						3	2	
CO			2	3	2	2	2		2					3	2	

Sl. No.	**Lab Experiment**
1	Study and Configure Raspberry Pi 3 a) Installing Debian OS for Raspberry pi3 b) Flashing and Booting for the Rpi3 for the first time
2	Introduction to Linux Environment – Practice Linux commands and simple python programs on Rpi3

	a) Write a Program for arithmetic operation in Python. b) Write a Program for looping statement in Python. b) Programming and Interfacing GPIOS – Blink LEDStart/Stop with Switch
3	Weather monitoring with DHT11 and data storage on cloud (ThingSpeak)
4	Write a program to store senor data in Rpi3 by creating database system.
5	Write a program to send sensor data to Cloud using Node Red service to perform Data Analytics using Rpi3
6	a) Interface and recording pictures and videos using Rpi3 b) Simple program for Colour object detector and tracker
7	Smart Home Application – Security System - Write a program to detect intruder with proximity sensor,record pictures and send alerts
8	Smart City Application – Street lighting System - Write a program to control street lights based on the ambience lighting
9	a) Writing python Code to implement of MQTT protocol on Rpi3 – Publisher b) Writing python Code to implement of MQTT protocol on Rpi3 – Subscriber
10	Writing python Code to implement of MQTT protocol on Rpi3 with multiple Publisher and Subscriber
Internet of Things Students Lab Projects	

IoT Lab Kit Content

• Raspberry Pi 3 model B (Wireless, Bluetooth)
• Micro SD memory card 8 GB • SD memory card adapter
• DHT 11 Sensor • Resistor,
• LED • Switch • Breadboard • Connecting wires
• HDMI to VGA Cable • Power Adapter and Micro USB cable

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C781**	**Advanced Communications and Networks Lab**	**0**	**0**	**4**	**2**

The objectives of this course are

- To Design and analyze.
- To Design and analyze.

Course Outcomes: After studying this course, the students will be able to

- To explore.
- To
- To understand
- To design

Mapping of Course Outcomes with Program Outcomes andProgram specific outcomes

CO	**Advanced Communications and Networks Lab (8C781)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Understand the practical concepts of converting analog signal to digital signal by using PCM, DM, ADM circuits of modulator and demodulator.			3						2				3	3	
CO2	Design and analyze ASK, FSK, PSK, DPSK, QPSK modulators and demodulators.			3						2				3	3	
CO3	Design and evaluate the performances of Linear Block Codes.			3						2				3	3	
CO4	Understand the practical concepts of Digital modulation techniques DPSK and QPSK			3						2				3	3	
CO5	Design of modulator and demodulator circuits using MAT Lab Simulation Tool.			3						2				3	3	

CO6	Design and implementation of Compander and Data Scrambler/Descrambler using Matlab.			3						2				3	3	
CO	Overall			3						2				3	3	

Syllabus Content

Syllabus Content

1. FSK Modulation and Demodulation technique

2.MSK –Modulation and Demodulation technique

3.DPSK -Modulation and Demodulation technique

4. QPSK Modulation and Demodulation technique

5. DQPSK Modulation and Demodulation technique

6 8QAM- Modulation and Demodulation technique

7.OFDM - Modulation and Demodulation technique

8. Convolution Encoding and Decoding technique

9. Study of CDMA-DSSS Communication System with BER Measurement

10. BER performance of AWGN wireless systemusing MAT LAB software

11. Simulation of RAKE Receiver for CDMA communication using MAT LAB software.

12. Simulate and test various types of PN codes, chip rate, spreading factor and processing gain on performance of DSSS in CDMA using MAT LAB software.

13. Simulation of OFDM system using MATLAB software.

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C782**	**Microwave and Optical Communications Lab**	**0**	**0**	**4**	**2**

Prerequisites: *MWOC*

Course Objectives:

The objective of this course is to provide the students an in-depth knowledge and practice about the microwave and optical components and in analyzing the microwave and optical equipments.

Course Objectives*: After studying this course, the students will be able to*

CO1	*Analyze the characteristics of RKO and GUNN diode*
CO2	*Understand the principles governing attenuation and working of DC*
CO3	*Measure the K, S, Z and f at microwave frequencies.*
CO4	*Analyse the design principles of circulator and magic Tee*
CO5	*Understand the basic characteristics of LED and LASER*
CO6	*Measure the DR,NA and Losses for Digital and Analog Links*

Mapping of Course Outcomes with Program Outcomes

CO	**Micro Wave and Optical Communications Lab (8C782)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Analyze the characteristics of RKO and GUNN diode		2		2					2				2		
CO2	Understand the principles governing attenuation and working of Directional coupler		2							2				2		
CO3	Measure the K, S, Z and f at microwave frequencies.	1	2	2			2			2				2		
CO4	Analyse the design principles of circulator and magic Tee	1	2							2				2		
CO5	Understand the basic characteristics of LED and LASER	2	2	3			2			2				3		2
CO6	Measure the DR, Numerical	2	2	3	2		3			2				3		2

	aperture and Losses for Digital and Analog Links															
CO	Overall	2	2	3	2		2			2				2		2

Part – A (Any 8 Experiments)

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. VSWR Measurement.
6. Impedance and Frequency Measurement.
7. Waveguide parameters measurement.
8. Scattering parameters of Circulator.
9. Scattering parameters of Magic Tee.

Part-B

1. Characterization of LED.
2. Characterization of Laser Diode.
3. Intensity modulation of Laser output through an optical fiber.
4. Measurement of NA

Syllabus for B. Tech (E.C.E.) IV Year I semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - I	**8C793**	**Summer Industry Internship - II**	**0**	**0**	**1**	**1**

Course Objective:

The students undergo industrial training so that he/she become industry-ready.

Course Outcomes:

At the end of the training, the student is able to

1. Select the real-time problem in the industry.
2. Analyze the requirements with respect to the problem statement
3. Design the optimal solution for the problem.
4. Implement the solution using the appropriate modern tools.
5. Present and submit the report

Mapping of Course Outcomes with Program Outcomes

CO	Summer Industry Internship – II (EVALUATION) (**8C793**)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Select the real-time problem in the industry.	2	2	2	2	3				3				2	2	
CO2	Analyze the requirements with respect to the problem statement		3	2	2	3				3				2	2	
CO3	Design the optimal solution for the problem.			3	2	3				3				1	2	
CO4	Implement the solution using the apropriate modern tools	2	2	2	3	3				3				2	3	
CO5	Present and submit the report	3	3	3	3	3				3				3	3	
CO	Overall	2	3	2		3				3				2	2	

Student shall carryout the project in industry during summer vacation for 3-6 weeks. There is internal and external Evaluation. Internal Evaluation carries 30 marks and external Evaluation carries 70 marks, Total 100 marks.

IV–II

Syllabus for B. Tech (E.C.E.) IV Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - II	**8C841**	**Low power VLSI design (PE-V)**	**3**	**0**	**0**	**3**

Pre-Requisites:

Course Objectives:

Course Outcomes:

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

CO1. understand the low power design
CO2. Learn BiCMOS processes
CO3. Apply low power concepts for different logic circuits.
CO4. Differentiate low power latches and flipflops.

Mapping of Course Outcomes with Program Outcomes

CO	**Low power VLSI design (8C841)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	understand the low power design	2	2		2									2	1	
CO2	Learn BiCMOS processes	2	2		2									2	1	
CO3	Apply low power concepts for different logic circuits	2	2		2									2	1	
CO4	Differentiate low power latches and flipflops	2	2		2									2	1	
CO	Overall	2	2		2									2	1	

UNIT I

Introduction, Low-Power design an overview, Low-Voltage, Low-Power design limitations: Power supply voltage, Threshold voltage, Scaling and Interconnect wires.

UNIT II

BiCMOS Processes: BiCMOS process using N-Well Process, BICMOS process using P-Well Process and BICMOS process using Twin-Well Process.

BiCMOS manufacturing and Integration considerations: Process considerations for CMOS device structures, Process considerations for Bipolar Transistors.

UNIT III

Isolation in BiCMOS: Isolation in Bipolar transistors-Junction isolation in the SBC process, Collector diffusion isolation; Isolation in MOS transistors-Local oxidation of Silicon, Deep trench isolation.

UNIT IV

Low-Voltage, Low-Power Logic Circuits-I: Conventional CMOS logic gates-Power dissipation in CMOS inverter, Basic NAND and NOR gates, Conventional BiCMOS logic gates-BiCMOS inverter, Basic driver configurations. Full swing with shunting devices.

UNIT V

Low-Voltage, Low-Power Logic Circuits-II: Full swing complementary MOS/Bipolar logic circuit, Full swing complementary MOS/Bipolar logic circuit with feedback, Merged BiCMOS digital circuit, Complementary BiCMOS circuits.

UNIT VI

Low-Power Latches and Flip-Flops: Introduction, Evolution of Latches and Flip-Flops.

TEXT BOOKS

1. CMOS/BiCMOS ULSI low voltage, low power by Yeo Rofail/ Goh(3 Authors)-Pearson Education Asia 1 st Indian reprint,2002

REFERENCES

1. Digital Integrated circuits ,J.Rabaey PH. N.J 1996
2. CMOS Digital ICs , Sung-moKang and Yusuf Leblebici 3 rd edition TMH 2003 (chapter 11)
3. VLSI DSP systems ,Parhi, John Wiley & sons, 2003 (chapter 17)
4. IEEE Trans Electron Devices, IEEE J.Solid State Circuits, and other National and International Conferences and Symposia

Syllabus for B. Tech (E.C.E.) IV Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - II	**8C842**	**System on Chip Architecture (PE-V)**	**3**	**0**	**0**	**3**

OBJECTIVES

After going through this course the student will be able to

- Understand the System Architecture and Processor Architecture, approach for a SOC Design.
- Learn the, Basic concepts in Processor Micro Architecture, and Learn Different Types of Processors like VLIW Processors, Superscalar Processors etc.
- Learn about SOC external memory, Scratchpads and Cache memory and Multilevel Caches.
- Learn the SOC Design approach, Design and evaluation, Applications Like Image compression etc

After studying this course, the students will be able to

1. Know basics of System Architecture
2. Understand the various types of Processors like VLIW Processors, Superscalar Processors.
3. Distinguish Cache memory and Multilevel Caches, SOC external memory.
4. Know the Concept of Inter Connect Architectures, SOC Standard Buses and Reconfiguration Technologies.
5. Know the concepts and issues related to Interconnect Configuration.
6. Explore the SOC Design approach and develop its applications.

Mapping of Course Outcomes with Program Outcomes

CO	**System-on Chip Architecture (8C842)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Know basics of System Architecture		2										3	3		
CO2	Understand the various types of Processors like VLIW Processors, Superscalar Processors		2	3									3	3		
CO3	Distinguish Cache memory and Multilevel Caches, SOC external memory												3	3		

CO4	Know the Concept of Inter Connect Architectures, SOC Standard Buses and Reconfiguration Technologies.		2	3									3	3		
CO5	Know the concepts and issues related to Interconnect Configuration												3	3		
CO6	Explore the SOC Design approach and develop its applications			3									3	3		
CO	overall		2	3									3	3		

UNIT-I: Introduction
Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, an approach for SOC Design, System Architecture and Complexity.

UNIT-II: Processors :
Introduction , Processor Selection for SOC, Basic concepts in Processor Architecture, Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT-III: Memory Design for SOC:
Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation , SOC Memory System, Models of Simple Processor – memory interaction.

UNIT-IV: Interconnect Customization and Configuration:
Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor.

UNIT-V: Interconnect Configuration:
Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration – overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT-VI: Application Studies / Case Studies:
SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

Text Books

- Computer System Design System-on-Chip – Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd.
- Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer

Reference Books

- ARM System on Chip Architecture – Steve Furber –2nd Ed., 2000, Addison Wesley Professional.
- System on Chip Verification – Methodologies and Techniques – PrakashRashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers.

Syllabus for B. Tech (E.C.E.) IV Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - II	**8C843**	**Radar Signal Processing (PE-V)**	**3**	**0**	**0**	**3**

Course Objectives:

Course Outcomes:

CO1: *Recognise the basics of Radar systems and its applications and its frequencies (Understand)*

CO2: *Differentiate the Radar parameters, how it affects the Range measurement. (Analyse)*

CO3: *Recall the Doppler Effect, and draw backs of CW radars. (Remember)*

CO4: *Discuss the basic concepts of Moving target indicators and evaluate the draw backs of MTI Radars.(Understand)*

CO5: Differentiate concept of scanning and tracking. (Analyse)

CO6: Understand various types of displays and different phased arrays

CO	**Radar Signal Processing (8C843)**	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	*Recognise the basics of Radar systems and its applications and its frequencies (Understand)*	3			2								3	2	1	2
CO2	*Differentiate the Radar parameters, how it affects the Range measurement. (Analyse)*	2	3	3	3								3	2	2	2
CO3	*Recall the Doppler Effect, and draw backs of CW radars. (Remember)*	1	2	3	2								3	2	1	2
CO4	*Discuss the basic concepts of Moving*	2	2	3	2			3					3	2	1	2

	target indicators and evaluate the draw backs of MTI Radars.(Under stand)															
CO5	*Differentiate concept of scanning and tracking. (Analyse)*			1	3			3					3	1	2	2
CO6	*Understand various types of displays and different phased arrays*			3	2								3	2	2	2
CO	*OVERALL*	2	2	3	2			3					3	2	2	2

UNIT I

BASICS OF RADAR AND RADAR SIGNAL POCESSING

Nature of Radar, Maximum Range, Radar Equation. Block Diagram. RadarFrequencies and Applications. Prediction of Range Performance.. Rx Noise.Modified Range Equation.Basic Radar Signal Processing, , Signal Models, components of a RadarSignal, Amplitude Models, clutter, Noise Model and Signal -to –NoiseRatio, Jamming,Frequency Models

UNIT-II

CW AND FMCW RADAR

Doppler Effect. CW Radar, Block diagram, Applications of CW Radar. Rxbandwidth requirements. FM CW Radar, Block diagram and characteristics.FM- CW Altimeter. The Doppler Shift, Spatial Models, Spectral Model

UNIT-III

MTI and Tracking RADAR

Block diagram of MTI Radar with Power Amplifier and Power Oscillators. NonCoherent MTI Radar. Delay line Cancellers. Double Cancellation. BlindSpeeds. Filter Characteristics. MTI vs Pulse Doppler Radar. Staggered PRF,Range gated Doppler Filters.

TRACKING RADARS

Tracking Radars: Sequential lobing. Conical Scan. Mono Pulse trackingRadars. Phase Comparison Mono Pulse.

UNIT-V

Sampling and Quantization of Pulsed Radar Signals, Domains andCriteria for Sampling, Radar Signals, Sampling in the Fast TimeDimension, Sampling in Slow Time – Selecting the Pulse

RepetitionInterval, Sampling the Doppler Spectrum, Sampling in the Spatial andAngle Dimensions, Quantization, I/Q Imbalance and Digital I/Q

UNIT-VI

Doppler Processing, Alternate Forms of the Doppler Spectrum, MovingTarget Indication (MTI), Pulse Doppler Processing, Pulse PairProcessing, Additional Doppler Processing Issues, Clutter Mapping andthe Moving Target Detector, MTI for moving plat forms

Text Books

1. Merrill I. Skolnik, Introduction to Radar Systems, McGraw-Hill, 2 nd Edition,1981.
2. Mark A. Richards, “Fundamentals of Radar Signal Processing”, McGraw Hill
3. Fred E. Nathanson, “Radar Design Principles: Signal Processing and TheEnvironment”,2ndEdition, 1999, PHI.

References

1. Merrill I.Skolnik,Introduction to Radar systems,McGraw-Hill,3 rd Edition,2001.
2. Byron Edde, Radar Principles,Technology,Applications. PearsonEdition,2004.
3. Peyton Z. Peebles, Jr., “Radar Principles”, 2004, John Wiley.
4. R. Nitzberg, “Radar Signal Processing and Adaptive Systems”, 1999, ArtechHouse.
5. F.E. Nathanson, “Radar Design Principles”, 1st Edition, 1969, McGraw Hill.

Syllabus for B. Tech (E.C.E.) IV Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - II	**8C844**	**5G Communications (PE-V)**	**3**	**0**	**0**	**3**

Pre-requisites:

Probability & Stochastic process, Cellular mobile Communications

Course Objectives:

This course is intended to impart to the students the principlesof

- The fundamental concepts and design principles in "Multiple-Input Multiple-Output" (MIMO) wireless communications –channel capacity, antenna diversity, space-time coding.
- The fundamental concepts in "Orthogonal Frequency-Division Multiplexing" (OFDM) communications – transmission, synchronization, peak-to-average power ratio (PAPR) reduction.
- This fundamental concepts of massive MIMO will present a comprehensive analytical development of the various concepts in massive MIMO and mmWave MIMO technologies for 5G together with practical insights and problem solving.

Course Outcome: After Learning this course, the student will be able to gain knowledge and understanding of:-

CO1	Learn 5G Technology advances and their benefits
CO2	Learn the key RF, PHY, MAC and air interface changes required to support 5G, OFDM's transceiverarchitecture
CO3	MIMO Capacity, space-timecoding
CO4	The problem of PAPR and how to reduce thePAPR. To understand how the OFDM receiver performssynchronization
CO5	Implementation options for 5G. Channel modeling and propagation
CO6	Learn Device to device communication and millimeter wave communication. Massive MIMO and mmWave MIMO technologies for 5G.

Mapping of Course Outcomes with Program Outcomes

CO	5G Communications (**8C844**)	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	OFDM's transceiver architecture	2	3	3	3	3								2	2	
CO2	The problem of PAPR and how to reduce the PAPR	2	3	3	3	3								2	2	
CO3	To understand how the OFDM	2	3	3	3	3								2	2	

	receiver performs synchronization															
CO4	Channel modeling and propagation	2	3	3	3	3								2	2	
CO5	MIMO Capacity, space-time coding	2	3	3	3	3								2	2	
CO6	Massive MIMO and mmWave MIMO technologies for 5G	2	3	3	3	3								2	2	
CO		2	3	3	3	3								2	2	

UNIT 1:
Overview of 5G Broadband Wireless Communications: Evaluation of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G. Introduction to Massive MIMO Wireless Systems, Generalized Spatial Modulation,mmWave MIMO Wireless Systems and Challenges.

UNIT 2:
Introduction to OFDM Effect- Multicarrier Modulation and Cyclic Prefix- Channel model and SNR performance- OFDM Issues of PAPR- Frequency and Timing Offset Issues. Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modeling for Wireless Communications, BER Performance Improvement with diversity.
BER Analysis for Space Time Coding, Transmit Beam forming, Receiver Selection Combining, Receiver Equal Combining, Receiver Maximal Ratio Combining.

UNIT 3: Introduction to MIMO, Beam forming Antennas, Diversity: Receive- antenna diversity; Transmit-antenna diversity, MIMO Diversity and applications, MIMO Channel Capacity of ZF, LMMSE, MMSE. MIMO Channel Capacity-SVD and Eigen modes of the MIMO Channel-MIMO Spatial Multiplexing – BLAST-MIMO Diversity – Alamouti, OSTBC, MRT-MIMO - OFDM.

UNIT 4: Millimeter-wave Communications – spectrum regulations, deployment scenarios, beam-forming, physical layer techniques, interference and mobility management, Massive MIMO propagation channel models, Channel Estimation in Massive MIMO, Massive MIMO with Imperfect CSI, Multi-Cell Massive MIMO, Pilot Contamination, Spatial Modulation (SM)

UNIT 5: Transmission and Design Techniques for 5G: Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques – orthogonal frequency division multiple accesses (OFDMA), generalized frequency division multiple accesses (GFDMA), non-

orthogonal multiple accesses (NOMA).

UNIT 6: The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mmWave MIMO Systems.
Device-to-device (D2D) and machine-to-machine (M2M) type communications – Extension of 4G D2D standardization to 5G, radio resource management for mobile broadband D2D, multi-hop and multi-operator D2D communications.

Text Books:

1. Principles of Modern Wireless Communication Systems – Aditya K Jagannatham
2. MIMO-OFDM for LTE, WiFi and WiMAX Li Wang, Ming Jiang, Lajos L. Hanzo, YosefAkhtmanWeily2011
3. MIMO-OFDM Wireless Communications with MATLAB Yong SooCho,Jaekwon Kim, Won YoungYang, hung G. Kang John Wiley & Sons(2010)
4. Martin Sauter "From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell.
5. AfifOsseiran, Jose.F.Monserrat, Patrick Marsch, "Fundamentals of 5G Mobile Networks" , Cambridge University Press.
6. AthanasiosG.Kanatos, KonstantinaS.Nikita, PanagiotisMathiopoulos, "New Directions in Wireless Communication Systems from Mobile to 5G", CRC Press.
7. Theodore S.Rappaport, Robert W.Heath, Robert C.Danials, James N.Murdock "Millimeter Wave Wireless Communications", Prentice Hall Communications.

References**:**

2. OFDM for Wireless Communications Systems Ramjee Prasad, Artech House Publishers(2004).
3. MIMO Wireless Communications EzioBiglieri Robert Calderbank Anthony Constantinides Andrea Goldsmith ArogyaswamiPaulraj H. Vincent Cambridge University Press(2007).
4. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons.
5. AmitabhaGhosh and RapeepatRatasuk "Essentials of LTE and LTE-A", Cambridge University Press.

Syllabus for B. Tech (E.C.E.) IV Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - II	**8C845**	**Deep Learning (PE-V)**	**3**	**0**	**0**	**3**

Pre-Requisites: Signals & Systems, Basics of Probability Theory, Linear Algebra & Calculus, Statistics and Machine Learning

Course Objectives:

The objective of this course is to provide the learners with a comprehensive understanding of Deep Learning Methods, Recurrent Neural Netwok and their applications.

Course Outcomes:

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

CO1. understand the basics and complexity of Deep Learning algorithms and their limitations

CO2. Learn modern notions in data analysis oriented computing

CO3. Confidently apply common Deep Learning algorithms in practice and implementing their own and

CO4. Differentiate various algorithms for sequence of data

Mapping of Course Outcomes with Program Outcomes

CO	Deep Learning (8C845)	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	introduce basic concepts and techniques of Machine Learning	3	2	3		3								3	3	
CO2	have a thorough understanding of the Supervised and Unsupervised learning techniques	2	2	3		3								3	3	
CO3	study the various probability based learning techniques	3	2	3		3								3	3	

CO4	analyze the dimensionality reduction models	3	2	2		3								2	3	
CO5	To understand graphical models of machine learning algorithms	2	2	3		3								3	3	
CO6	Apply analytical learning algorithms	2	2	3		3								3	3	
CO	OVERALL	2	2	3		3								3	3	

Syllabus

UNIT – I Basics to Deep Learning

Introduction, History, Perceptron, MLP, review of Neural Network- Feedforward Neural Networks and Back Propagation- Gradient Decent and varients, Batch-normalization.

Activation Functions : Sigmoid,ReLU, Hyperbolic Tangent Functions, Softmax

UNIT – II Introduction to TensorFlow (Python will be used for understanding)

Computational Graph, Creating a Graph, Regression example, Handwritten digit classification using TensorFlow, TensorBoard, Keras Library

UNIT – III Deep Learning

Deep Feed Forward network, Training Deep Neural Networks using Back Propagation-Setup and initialization issues, vanishing and exploding Gradientproblems, Gradient- Descent Strategies, Overfitting and Generalizaton, Cross Validation, Feature Selection,Regularizations, Dropouts, Hyperparameters.

UNIT – IV :CNN (Convolutional Neural Networks)

Basic structure of Convolutional Network, Shortcomings of Feature Selection - Full Description of the Convolutional Layer - Max Pooling-Full Architectural Description of Convolution Networks, Backpropagation in CNNs, Evolution of CNN Architectures for Image Classification, Fine tuning in CNN.

UNIT – III Auto-encoders

Auto-encoders Neural Networks, Training, Undercomplete and Overcompleteautoencoders, Convolutional auto-encoders, De-convolution layer, Transposed convolution, Sparsely Regulated auto-encoders, Denoisingauto-encoders, Stacked auto-encoders, Variational auto-encoders.

UNIT – VI Recurrent Neural Networks

Introduction to RNN, Unfolding Computational Graph, Recurrent hidden units and Training Loss, Recurrence through output only, Forward Propagation, Teacher Forcing, Seq2Seq RNN, LSTM, GRU – Comparison of LSTM and GRUs, RNN applications.

BOOKS

1. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly Media, 2017.
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning (Adaptive omputation and Machine Learning series", MIT Press, 2017.
3. CharuC.Aggarwal "Neural Networks and Deep learning" Springer International Publishing, 2018

Reference Books

1. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Educatio2004.

Syllabus for B. Tech (E.C.E.) IV Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - II	**8C846**	**EMI/EMC (PE-V)**	**3**	**0**	**0**	**3**

UNIT - I

Introduction, Natural and Nuclear Sources of EMI / EMC: Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations, An overview of EMI / EMC, Natural and Nuclear sources of EMI.

UNIT - II

EMI from Apparatus, Circuits and Open Area Test Sites: Electromagnetic emissions, Noise from relays and switches, Non-linearity in circuits, passive intermodulation, Cross talk in transmission lines, Transients in power supply lines, Electromagnetic interference (EMI), Open area test sites and measurements.

UNIT - III

Radiated and Conducted Interference Measurements: Anechoic chamber, TEM cell, GH TEM Cell, Characterization of conduction currents / voltages, Conducted EM noise on power lines, Conducted EMI from equipment, Immunity to conducted EMI detectors and measurements, ESD,

UNIT - IV

ESD, Electrical fast transients / bursts, Electrical surges.

UNIT - V

Grounding, Shielding, Bonding, and EMI filters: Principles and types of grounding, Shielding, and bonding, Characterization of filters, Power lines filter design.

UNIT - VI

Cables, Connectors, Components and EMC Standards: EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

TEXT BOOKS:

1. Dr. V.P. Kodali, IEEE Publication, “Engineering Electromagnetic Compatibility”, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
3. IIT – Delhi, “Electromagnetic Interference and Compatibility IMPACT series”, Modules 1 – 9.

REFERENCE BOOK:

1. C.R. Pal., “Introduction to Electromagnetic Compatibility”, Ny John Wiley, 1992.

Syllabus for B. Tech (E.C.E.) IV Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - II	**8CC53**	**Embedded Systems Concepts (OE-III)**	**2**	**0**	**0**	**2**

Course Objectives **-** ***The student will learn about***

1. *The constraints and challenges of an Embedded System design*
2. *The 8051 Architecture, Assembly Language Programming , Interfacing and Interrupt handling mechanism*
3. *Interfacing with various bus protocols*
4. *Concepts and constraints related to real-time systems*

Course Outcomes **–** ***After completing this course, student shall be able to***

1. *Identify the design constraints and challanges of a modern embedded system.*
2. *Write ALP for 8051 architecture*
3. *Design hardware interface with 8051 to DC motor, keyboard, LCD.*
4. *Implement interfaces for Embedded System using various protocols and hardware modules.*
5. *Explain the concepts and design requirements related to a real time systems.*
6. *Getting embedded software into target system – Debugging.*

CO	**Embedded Systems Concepts (8CC53)**	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	*Identify the design constraints and challanges of a modern embedded system.*	2		3	2	1							2	2	2	
CO2	*Write ALP for 8051 architecture*	2	2	3	2	1							2	2	2	
CO3	*Design hardware interface with 8051 to DC motor, keyboard, LCD*	2	2	3	2	1							2	2	2	
CO4	*Implement interfaces for Embedded System using various protocols and hardware modules*	2	2	3	2	1							2	2	2	
CO5	*Explain the concepts and design*	2		3	2	1							2	2	2	

	requirements related to a real time systems															
CO6	*Getting embedded software into target system – Debugging*	2		3	2	1							2	2	2	
CO	OVERALL	2	2	3	2	1							2	2	2	

UNIT – I: Introduction to Embedded Systems
Embedded Systems, Comparing Embedded and General Computing, Complex System Design and Processors, Classification of Embedded Systems, Embedded System Design Process, Formalization of System Design, Embedded SOC and VLSI Circuit Technology, Application examples of Embedded Systems.

UNIT – II: 8051 Architecture, Memory Organization and Programming
8051 Architecture, features, Addressing modes, Instruction set, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data, Input/Output, Interrupts; The Assembly Language programming Process, Programming the 8051, Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, use of C programming for 8051.

UNIT – III: 8051 Real World Interfacing
Part A - Real World Interfacing, Performance metrics, Memory map, Processor and Memory selection,
Part B - IO Subsystem, Sensors and Actuators, LED and LCD Interfacing, Keyboard Interfacing, Stepper Motor Interfacing, DC motor Interfacing Using PWM

UNIT – IV: Embedded Communication Interface
Serial and Parallel Communication, Timer and Counting Devices, Watchdog Timer, Real Time Clock, I^2C, SPI protocol, ISA , PCI, Internet Enabled Systems, Wireless and Mobile Systems Protocols

UNIT – V: Introduction to Real - Time Operating Systems
Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment. (Chapter 6 and 7 from Text Book 3, SImon).

UNIT – VI: Basic Design Using a Real-Time Operating System : Principles, Semaphores and Queues, HardReal-Tjme Scheduling Considerations, Saving Memory and Power, An example RTOS like uC-OS (Open Source);
Embedded Software Development Tools: Host and Target machines, Linker! Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging

TEXT BOOKS:

1. Embedded Systems- Architectuer, Programming and Design 2E, Raj Kamal, TMH
2. Introduction to Embedded Systems, K.Shibu, Tata McGraw-Hill
3. The 8051 Microcontroller And Embedded Systems Using Assembly And C – Mazidi, Pearson Education India, 2nd edition, 2008.
4. An Embedded Software Primer, David E. Simon, Pearson Education

REFERENCES:

1. Computers and Components: principles of embedded *computing* system design, Wayne Wolf, Elseveir.

2. 8051 Application Notes by Atmel.

Syllabus for B. Tech (E.C.E.) IV Year II semester						
Year/Sem	**Sub. Code**	**Subject Name**	**L**	**T**	**P/D**	**C**
IV - II	**8C894**	**Major Project**	**0**	**0**	**10**	**5**

Prerequisite : All Courses till this semester

Course Objectives: To enhance the knowledge on selecting a project, learn related tools and enhance programming and communication skills for employability.

Course Outcomes:

At the end of this course the student will be able to

1. Develop plans with relevant people to achieve the project's goals
2. Break work down into tasks and determine handover procedures
3. Identify links and dependencies, and schedule to achieve deliverables
4. Estimate the human and physical resources required, and make plans to obtain the necessary resources
5. Allocate roles with clear lines of responsibility and accountability with team spirit.
6. Design and develop the software or prototype to meet societal needs

Mapping of Course Outcomes with Program Outcomes

CO	**Major Project (8C894)**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	Develop plans with relevant people to achieve the project's goals .	3	3	2	2	2	1	1		2		1	2	3	2	2
CO2	Break work down into tasks and determine handover procedures .	2	3	3	3	2	3	3	2	2	2	2	2	3	3	3
CO3	Identify links and dependencies, and schedule to achieve deliverables	3	2	2	3	3	2	2	3	3	2	2	2	3	3	2
CO4	Estimate the human and physical	3	3	3	3	3	2	2	3	2	2	2	2	2	3	3

	resources required, and make plans to obtain the necessary resources															
CO5	Allocate roles with clear lines of responsibility and accountability with team spirit.		1			2	1		2	2	3	2	2	1	1	2
CO6	Design and develop the software or prototype to meet societal needs		1	2	2	3	2	2	3	2	3	2	3	3	3	3
CO	Overall	3	2	2	3	3	2	2	3	2	2	2	2	3	3	3

A project shall be carried out by a group of students consisting of 2 to 3 in number in fourth year second semester. This work shall be carried out under the guidance of the faculty assigned as internal guide and shall involve design, fabrication, software development or any other significant activity. This can be of interdisciplinary nature also.

Out of total 100 marks for project work (in the final year second semester), 30 marks shall be for Internal Evaluation and 70 marks for the External Evaluation at the end of the Semester.

External Evaluation of the project (viva-voce) shall be conducted by a committee appointed by the Chief Superintendent. The committee consists of an external examiner, HOD, a Senior Faculty Member, Project Coordinator and Internal Guide.

Division of marks for internal assessment – 30 marks

Sl.No	**Description**	**Marks**
1	Progress of Project work and the corresponding interim report as evaluated by Project Review Committee at the end of 6 weeks	5 marks
2	Seminar at the end of 6 weeks	5 marks
3	Progress of Project work as evaluated by Project Review Committee at the end of 11 weeks	5 marks
4	Seminar at the end of 11 weeks	5 marks
5	Evaluation by Project Review Committee at the end of 15 weeks and Final Project Report	5 marks
6	Final presentation and defence of project	5 marks
	Total	**30 marks**

Division of Marks for External Evaluation – 70 Marks

Sl.No	Description	Marks
1	Final Project Report	10 marks
2	Presentation	20 marks
3	Demonstration / Defense of Project	40 marks
4	**TOTAL**	**70 marks**