UNIVERSITY VISION AND MISSION

VISION

B.S. Abdur Rahman Institute of Science & Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned University.
- To empower the youth through quality education and to provide professional leadership.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

VISION AND MISSION OF THE DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

The Department of Electronics and Communication Engineering envisions to be a leader in providing state of the art education through excellence in teaching, training, and research in contemporary areas of Electronics and Communication Engineering and aspires to meet the global and socio economic challenges of the country.

MISSION

- The Department of Electronics and Communication Engineering, endeavors to produce globally competent Engineers prepared to face challenges of the society.
- To enable the students to formulate, design and solve problems in applied science and engineering.
- To provide excellent teaching and research environment using state of the art facilities.
- To provide adequate practical training to meet the requirement of the Electronics & communication industry.
- To train the students to take up leadership roles in their career or to pursue higher education and research.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
M.Tech. (Communication Systems)

PROGRAMME EDUCATIONAL OBJECTIVES

- To educate and train the graduates with knowledge and skills necessary to formulate, design and solve problems in communication systems, advanced radiation systems, signal processing, optical and computer networks.
- To provide knowledge in software and hardware tools for real time applications in RF system design, Wireless Communication, Signal Processing and Network design.
- To provide scope for Applied Research and innovation in the various domains of communication system,enabling the graduates to carry out research and development in Industry and Academia.
- To enhance communication and soft skills of students to make them work effectively as a team.

PROGRAMME OUTCOMES

On completion of the program, the graduates will

- Have the ability to design and analyze different types of communication systems.
- Have the capability to develop real time applications in the area of RF system design, Wireless Communication, Signal Processing and Network design using software and hardware tools.
- Be able to undertake research projects and disseminate the knowledge to the society in the related domains of communication systems.
- Be able to communicate effectively and work as a team in their professional career.

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

REGULATIONS 2013
FOR
M.TECH. DEGREE PROGRAMMES

B.S. ABDUR RAHMAN UNIVERSITY, CHENNAI 48. REGULATIONS - 2013 FOR M.TECH / MCA / M.Sc. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

i) **"Programme"** means Post Graduate Degree Programme (M.Tech./ MCA / M.Sc.)

ii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Applied Mathematics, Structural Dynamics, Computer Aided Design, etc.

iii) **"University"** means B.S.Abdur Rahman University, Chennai, 600048.

iv) **"Institution"** unless otherwise specifically mentioned as an autonomous or off campus institution means B.S.Abdur Rahman University.

v) **"Academic Council"** means the Academic Council of this University.

vi) **"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S.Abdur Rahman University.

vii) **"Dean (Student Affairs)"** means Dean(Student Affairs) of B.S.Abdur Rahman University.

viii) **"Controller of Examinations"** means the Controller of Examinations of B.S.Abdur Rahman University who is responsible for conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

2.1 P.G. Programmes Offered

The various P.G. Programmes and their modes of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
M.Tech.	Part Time - Day / Evening
M.C.A.	Full Time
M. Sc.	Full Time

2.2 MODES OF STUDY

2.2.1 Full-time

Students admitted under "Full-Time" shall be available in the Institution during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

2.2.2 A full time student, who has completed all non-project courses desiring to do the Project work in part-time mode for valid reasons, shall apply to the Dean (Academic Affairs) through the Head of the Department, if the student satisfies the clause 2.3.4 of this Regulation. Permission may be granted based on merits of the case. Such conversion is not permitted in the middle of a semester.

2.2.3 Part time - Day time

In this mode of study, the students are required to attend classes for the courses registered along with full time students.

2.2.4 Part time - Evening

In this mode of study, the students are required to attend normally classes in the evening and on Saturdays, if necessary.

2.2.5 A part time student is not permitted to convert to full time mode of study.

2.3 ADMISSION REQUIREMENTS

2.3.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this University as specified in the Table shown for eligible entry qualifications for admission to P.G. programmes or any other degree examination of any University or authority accepted by this University as equivalent thereto.

2.3.2 Eligibility conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by this Institution from time to time.

2.3.3 All part-time students should satisfy other conditions regarding experience, sponsorship etc., which may be prescribed by this Institution from time to time. the campus of this Institution.

2.3.4 A student eligible for admission to M.Tech. Part Time / Day Time programme shall have his/her permanent place of work within a distance of 65km from the campus of this Institution.

2.3.5 Student eligible for admission to M.C.A under lateral entry scheme shall be required to have passed three year degree in B.Sc (Computer Science) / B.C.A / B.Sc (Information Technology)

3.0 DURATION AND STRUCTURE OF THE P.G. PROGRAMME

3.1 The minimum and maximum period for completion of the P.G. Programmes are given below:

Programme	Min.No.of Semesters	Max.No.of Semesters
M.Tech. (Full Time)	4	8
M.Tech. (Part Time)	6	12
M.C.A. (Full Time)	6	12
M.C.A. (Full Time) – (Lateral Entry)	4	8
M.Sc. (Full Time)	4	8

3.2 The PG. programmes consist of the following components as prescribed in the respective curriculum

i. Core courses
ii. Elective courses
iii. Project work / thesis / dissertation
iv. Laboratory Courses
v. Case studies
vi. Seminars
vii. Industrial Internship

3.3 The curriculum and syllabi of all PG. programmes shall be approved by the Academic Council of this University.

3.4 The minimum number of credits to be earned for the successful completion of the programme shall be specified in the curriculum of the respective specialization of the P.G. programme.

3.5 Each academic semester shall normally comprise of 80 working days. Semester-end examinations will follow immediately after the last working day.

ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
01.	Civil Engineering	M.Tech. (Structural Engineering)	B.E / B.Tech. (Civil Engineering) / (Structural Engineering)
		M.Tech. (Construction Engineering and Project Management)	
02.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Auto / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M.Tech. CAD / CAM	
03.	Polymer Engineering	M.Tech. (Polymer Technology)	B.E./ B.Tech. degree Mech./Production/ Polymer Science or Engg or Tech / Rubber Tech / M.Sc (Polymer Sc./ Chemistry Appl. Chemistry)
04.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
		M.Tech. (Power Electronics & Drives)	
05.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation)
		M.Tech.(VLSI and Embedded Systems)	B.E./ B.Tech. in ECE / Electronics / EIE / ICE / EEE
		M.Tech.(Signal Processing)	
06.	ECE Department jointly with Physics Dept	M.Tech. (Optoelectronics and Laser Technology)	B.E./B.Tech. (ECE / EEE / Electronics / EIE / ICE) M.Sc (Physics / Materials Science / Electronics / Photonics)
07.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E./ B.Tech. (EIE/ICE/Electronics/ECE/ EEE)
08.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics) MCA
		M.Tech. (Software Engineering)	B.E. / B.Tech. (CSE / IT) MCA
		M.Tech (Network Security)	B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics) MCA
		M.Tech (Computer and Predictive Analytics)	
		M.Tech. (Computer Science and Engineering with specialization in Big Data Analytics)	
09	Information Technology	M.Tech. (Information Technology)	B.E /B.Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics) MCA
		M.Tech. (Information Security & Digital Forensics)	

ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
10	Computer Applications	M.C.A.	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		M.C.A. (Full Time) – (Lateral Entry)	B.Sc Computer Science / B.Sc Information Technology / B.C.A
		M.Tech. (Systems Engineering and Operations Research)	BE / B.Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
		M.Tech. (Data & Storage Management)	
11	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the Subjects of Study.
		M.Sc. Mathematics	B.Sc. (Mathematics)
12	Physics	M.Sc.(Physics)	B.Sc.(Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
		M.Sc. (Material Science)	
13	Chemistry	M.Sc.(Chemistry)	B.Sc (Chemistry) of B.Sc. (Applied Science)
14	Life Sciences	M.Sc. Molecular Biology & Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Genetics	
		M.Sc. Biotechnology	
		M.Sc. Microbiology	
		M.Sc. Bioscience	

3.6 The curriculum of PG programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Minimum prescribed credit range
M.Tech.	75 to 85
M.C.A.	120 to 130
M.Sc.	75 to 85

3.7 Credits will be assigned to the courses for all P.G. programmes as given below:

* One credit for one lecture period per week
* One credit for one tutorial period per week
* One credit each for seminar/practical session/project of two or three periods per week
* One credit for two weeks of industrial internship.

3.8 The number of credits registered by a student in non-project semester and project semester should be within the range specified below:

P.G. Programme	Non-project Semester	Project semester
M.Tech. (Full Time)	15 to 29	12 to 20
M.Tech. (Part Time)	6 to 18	12 to 16
M.C.A. (Full Time)	15 to 29	12 to 20
M.Sc. (Full Time)	15 to 25	12 to 20

3.9 The electives from the curriculum are to be chosen with the approval of the Head of the Department.

3.10 A student may be permitted by the Head of the Department to choose electives offered from other PG programmes either within the Department or from other Departments up to a maximum of three courses during the period of his/her study, provided the Heads of the Departments offering such courses also agree.

3.11 To help the students to take up special research areas in their project work and to enable the department to introduce courses in latest/emerging areas in the curriculum, "Special Electives" may be offered. A student may be permitted to register for a "Special Elective" up to a maximum of three credits during the period of his/her study, provided the syllabus of this course is recommended by the Head of the Department and approved by the Chairman, Academic Council before the commencement of the semester, in which the special elective course is offered. Subsequently, such course shall be ratified by the Board of Studies and Academic Council.

3.12 The medium of instruction, examination, seminar and project/thesis/ dissertation reports will be English.

3.13 Industrial internship, if specified in the curriculum shall be of not less than two weeks duration and shall be organized by the Head of the Department.

3.14 PROJECT WORK/THESIS/DISSERTATION

3.14.1 Project work / Thesis / Dissertation shall be carried out under the supervision of a qualified teacher in the concerned Department.

3.14.2 A student may however, in certain cases, be permitted to work for the project in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the faculty periodically and to attend the review committee meetings for evaluating the progress.

3.14.3 Project work / Thesis / Dissertation (Phase - II in the case of M.Tech.) shall be pursued for a minimum of 16 weeks during the final semester, following the preliminary work carried out in Phase-1 during the previous semester.

3.14.4 The Project Report/Thesis / Dissertation report / Drawings prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the concerned department.

3.14.5 The deadline for submission of final Project Report / Thesis / Dissertation is within 30 calendar days from the last working day of the semester in which Project / Thesis / Dissertation is done.

3.14.6 If a student fails to submit the Project Report / Thesis / Dissertation on or before the specified deadline he / she is deemed to have not completed the Project Work / Thesis / dissertation and shall re-register the same in a subsequent semester.

3.14.7 A student who has acquired the minimum number of total credits prescribed in the Curriculum for the award of Masters Degree will not be permitted to enroll for more courses to improve his/her cumulative grade point average (CGPA).

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

A faculty member will be nominated by the HOD as Class Advisor for the whole class.

He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the students will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment every semester.

5.0 CLASS COMMITTEE

5.1 Every class of the PG Programme will have a Class Committee constituted by the Head of the Department as follows:

i. Teachers of all courses of the programme

ii. One senior faculty preferably not offering courses for the class, as Chairperson.

iii. Minimum two students of the class, nominated by the Head of the Department.

iv. Class Advisor / Faculty Advisor of the class - Ex-Officio Member

v. Professor in-charge of the PG Programme - Ex-Officio Member.

5.2 The Class Committee shall be constituted by the respective Head of the Department of the students.

5.3 The basic responsibilities of the Class Committee are to review periodically the progress of the classes to discuss problems concerning curriculum and syllabi and the conduct of classes. The type of assessment for the course will be decided by the teacher in consultation with the Class Committee and will be announced to the students at the beginning of the semester. Each Class Committee will communicate its recommendations to the Head of the Department and Dean (Academic Affairs). The class committee, without the student members, will also be responsible for finalization of the semester results and award of grades.

5.4 The Class Committee is required to meet at least thrice in a semester, first within a week of the commencement of the semester, second, after the first

assessment and the third, after the semester-end examination to finalize the grades.

6.0 COURSE COMMITTEE

Each common theory course offered to more than one group of students shall have a “Course Committee” comprising all the teachers teaching the common course with one of them nominated as Course coordinator. The nomination of the Course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The Course Committee shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the Course Committee may also prepare a common question paper for the test(s).

7.0 REGISTRATION AND ENROLMENT

7.1 For the first semester every student has to register and enroll for all the courses.

7.2 For the subsequent semesters registration for the courses will be done by the student during a specified week before the semester-end examination of the previous semester. The curriculum gives details of the core and elective courses, project and seminar to be taken in different semester with the number of credits. The student should consult his/her Faculty Adviser for the choice of courses. The Registration form shall be filled in and signed by the student and the Faculty Adviser.

7.3 From the second semester onwards all students shall pay the prescribed fees and enroll on a specified day at the beginning of a semester.

7.4 A student will become eligible for enrolment only if he/she satisfies clause 9 and in addition he/she is not debarred from enrolment by a disciplinary action of the Institution. At the time of enrolment a student can drop a course registered earlier and also substitute it by another course for valid reasons with the consent of the Faculty Adviser. Late enrolment will be permitted on payment of a prescribed fine up to two weeks from the date of commencement of the semester.

7.5 Withdrawal from a course registered is permitted up to one week from the date of the completion of the first assessment test.

7.6 Change of a course within a period of 15 days from the commencement of the course, with the approval of Dean (Academic Affairs), on the recommendation of the HOD, is permitted.

7.7 Courses withdrawn will have to be taken when they are offered next if they belong to the list of core courses.

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. Such student has to rejoin only in the same semester from where he left. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

9.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum No. of credits to be earned to enroll for project semester
M.Tech. (Full time)	18 (III semester)
M.Tech. (Part time)	18 (V semester)
M.C.A. (Full time)	45 (V semester)
M.C.A. (Full time) – (Lateral Entry)	22 (V semester)
M.Sc. (Full time)	30 (IV semester) if project is in IV semester 18 (III semester) if project is in III semester

9.2 If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

10.0 DISCIPLINE

10.1 Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which will tend to bring down the prestige of the Institution.

10.2 Any act of indiscipline of a student reported to the Head of the Institution will be referred to a Discipline and Welfare Committee for taking appropriate action.

10.3 Every student should have been certified by the HOD that his / her conduct and discipline have been satisfactory.

11.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

Attendance rules for all Full-time programme and Part-time – Day-time programmes are given in the following sub-clause.

11.1 A student should secure not less than 75% overall attendance in that semester taking into account the total no. of periods in all courses put together attended by the student as against the total no. of periods in all courses offered during that semester. If a student who could secure overall attendance between 65% and 75% only in a particular semester due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level sports events with prior permission from the Officials concerned shall be given exemption from the prescribed attendance requirement and he / she shall be permitted to appear for the current semester examinations.

The students who do not fulfill the above attendance requirement will not be permitted to write the semester end examination and will not be permitted to move to next semester. Such students should repeat all the courses of the semester in the next Academic year.

11.2 The faculty member of each course shall furnish the cumulative attendance details to the class advisor. The class advisor will consolidate and furnish the list of students who have earned less than 75% overall attendance, to the Dean (Academic Affairs) through the Head of the Department / School Dean. Thereupon, the Dean (Academic Affairs) shall issue orders preventing students from appearing for the semester end examination of all the courses of that semester.

11.3 A student who is awarded "U" grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course whenever the course is offered. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the semester-end (re-do) examination. If any student obtained "U" grade, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

11.4 If a student with "U" grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will not be permitted to write the semester end examination and his / her earlier 'U' grade and continuous assessment marks shall continue.

12.0 ASSESSMENTS AND EXAMINATIONS

12.1 The following rule shall apply to the full-time and part-time PG programmes (M.Tech./ M.C.A. / M.Sc.)

For lecture-based courses, normally a minimum of two assessments will be made during the semester. The assessments may be combination of tests and assignments. The assessment procedure as decided in the Class Committee will be announced to the students right from the beginning of the semester by the course teacher.

12.2 There shall be one examination of three hours duration, at the end of the semester, in each lecture based course.

12.3 The evaluation of the Project work will be based on the project report and a Viva-Voce Examination by a team consisting of the supervisor concerned, an Internal Examiner and External Examiner to be appointed by the Controller of Examinations.

12.4 At the end of industrial internship, the student shall submit a certificate from the organization and also a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a Departmental Committee constituted by the Head of the Department.

13.0 WEIGHTAGES

13.1 The following shall be the weightages for different courses:

i) Lecture based course

Two continuous assessments	- 50%
Semester-end examination	- 50%

ii) Laboratory based courses

Laboratory work assessment	- 75%
Semester-end examination	- 25%

iii) Project work

Periodic reviews	- 50%
Evaluation of Project Report by External Examiner	- 20%
Viva-Voce Examination	- 30%

13.2 Appearing for semester end examination for each course (Theory and Practical) is mandatory and a student should secure a minimum of 40% marks in semester end examination for the successful completion of the course.

13.3 The markings for all tests, tutorial, assignments (if any), laboratory work and examinations will be on absolute basis. The final percentage of marks is calculated in each course as per the weightages given in clause 13.1.

14.0 SUBSTITUTE EXAMINATION

14.1 A student who has missed for genuine reasons any one of the three assessments including semester-end examination of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident or admissions to a hospital due to illness, etc.

14.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean (Academic Affairs) through the Head of the department within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

15.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

15.1 Based on the semester performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and the corresponding grade points are as follows, but grading has to be relative grading

Letter grade	Grade points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	-
AB	-

Flexible range grading system will be adopted

"W" denotes withdrawal from the course.

"U" denotes unsuccessful performance in a course.

"AB" denotes absent for the semester end examination

15.2 A student is considered to have completed a course successfully if he / she secure five grade points or higher. A letter grade 'U' in any course implies unsuccessful performance in that course.

15.3 A course successfully completed cannot be repeated for any reason.

16.0 AWARD OF LETTER GRADE

16.1 A final meeting of the Class Committee without the student member(s) will be convened within ten days after the last day of the semester end examination. The letter grades to be awarded to the students for different courses will be finalized at the meeting.

16.2 After finalization of the grades at the class committee meeting the Chairman will forward the results to the Controller of Examinations, with copies to Head of the Department and Dean (Academic Affairs).

17.0 DECLARATION OF RESULTS

17.1 After finalization by the Class Committee as per clause 16.1 the Letter grades awarded to the students in the each course shall be announced on the

departmental notice board after duly approved by the Controller of Examinations.

17.2 In case any student feels aggrieved about the results, he/she can apply for revaluation after paying the prescribed fee for the purpose, within one week from the announcement of results.

A committee will be constituted by the concerned Head of the Department comprising of the Chairperson of the concerned Class Committee (Convener), the teacher concerned and a teacher of the department who is knowledgeable in the concerned course. If the Committee finds that the case is genuine, it may jointly revalue the answer script and forward the revised marks to the Controller of Examinations with full justification for the revision, if any.

17.3 The “U” and “AB” grade once awarded stays in the grade sheet of the students and is not deleted when he/she completes the course successfully later. The grade acquired by the student later will be indicated in the grade sheet of the appropriate semester.

18.0 COURSE REPETITION AND ARREARS EXAMINATION

18.1 A student should register to re-do a core course wherein "W" grade is awarded. If the student is awarded "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

18.2 A student who is awarded “U” or “AB” grade in a course shall write the semester-end examination as arrear examination, at the end of the next semester, along with the regular examinations of next semester courses.

18.3 A student who is awarded “U” or “AB” grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course whenever the course is offered. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the end-semester (re-do) examination.

18.4 If any student obtained “U” or “AB” grade, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

18.5 If a student with “U” or “AB” grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she

will not be permitted to write the semester end examination and his / her earlier 'U' grade and continuous assessment marks shall continue.

19.0 GRADE SHEET

19.1 The grade sheet issued at the end of the semester to each student will contain the following:

(i) the credits for each course registered for that semester.

(ii) the performance in each course by the letter grade obtained.

(iii) the total credits earned in that semester.

(iv) the Grade Point Average (GPA) of all the courses registered for that semester and the Cumulative Grade Point Average (CGPA) of all the courses taken up to that semester.

19.2 The GPA will be calculated according to the formula

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i} \qquad Where\ \ n = number\ of\ courses$$

where C_i is the number of credits assigned for i^{th} course GP_i - Grade point obtained in the i^{th} course For the cumulative grade point average (CGPA) a similar formula is used except that the sum is over all the courses taken in all the semesters completed up to the point of time.

'W' grade will be excluded for GPA calculations.

'U', 'AB' and 'W' grades will be excluded for CGPA calculations.

19.3 Classification of the award of degree will be as follows:

CGPA	Classification
8.50 and above, having completed all courses in first appearance	First class with Distinction
6.50 and above, having completed within a period of 2 semesters beyond the programme period	First Class
All others	Second Class

However, to be eligible for First Class with Distinction, a student should not have obtained U grade in any course during his/her study and should have completed the PG Programme within a minimum period covered by the minimum duration (clause 3.1) plus authorized break of study, if any (clause 8). To be eligible for First Class, a student should have passed the examination in all courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

20.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

20.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

i) successfully acquired the required credits as specified in the Curriculum corresponding to his/her programme within the stipulated time,

ii) no disciplinary action is pending against him/her

20.2 The award of the degree must be approved by the University.

21.0 POWER TO MODIFY

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

CURRICULUM AND SYLLABI FOR M.TECH. (COMMUNICATION SYSTEMS) (FOUR SEMESTERS / FULL TIME)

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MAB6186	Applied Mathematics for Electronics Engineers	3	1	0	4
2.	ECB6102	Advanced Radiation Systems	3	0	0	3
3.	ECB6103	Modern Digital Communication Techniques	3	1	0	4
4.	ECB6104	Advanced Digital Signal Processing	3	0	0	3
5.		Elective I	3	0	0	3
6.	ECB6101	Research Methodology for Electronics Engineers	3	0	0	3
7.	ECB6105	Communication System Lab - I	0	0	3	1
8.	ECB6106	Seminar	0	0	2	1
						22

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1	ECB6211	Mobile Communication Nertowrks	3	0	0	3
2	ECB6212	Satellite Communication	3	0	0	3
3	ECB6213	Microwave Integrated Circuits	3	0	0	3
4	ECB6214	Multimedia Compression Techniques	3	0	0	3
5		Elective II	3	0	0	3
6		Elective III	3	0	0	3
7	ECB6215	Communication System Lab - II	0	0	3	1
8	ECB6216	Design / Fabrication Project	0	0	3	1
						20

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1.		Elective IV	3	0	0	3
2.		Elective V	3	0	0	3
3.		Elective VI	3	0	0	3
4.	ECB7102	Project Management	3	0	0	3
5.	ECB7101	Project Work - Phase I	0	0	12	6*
						12

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1.	ECB7101	Project Work - Phase II	0	0	36	18*
						18 + 6 = 24

* Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

Total Credit : 79

LIST OF ELECTIVES

Sl. No.	Course Code	Course Title
1.	ECBY01	Digital Image Processing
2.	ECBY02	Simulation of Communication Systems and Networks
3.	ECBY03	Global Tracking and Positioning Systems
4.	ECBY04	Electromagnetic Interference and Compatibility in System Design
5.	ECBY05	High Performance Communication Networks
6.	ECBY06	Digital Communication Receivers
7.	ECBY07	Optical Communication Networks
8.	ECBY08	Advanced Microwave systems
9.	ECBY09	Speech and Audio Signal Processing
10.	ECBY10	Network Security
11.	ECBY11	Wireless Communications
12.	ECBY12	Medical Image Processing
13.	ECBY13	Network Management
14.	ECBY14	Internet Working Multimedia
15.	ECBY15	Internet Denial of Service
16.	ECBY16	QoS in Ad Hoc Wireless Networks
17.	ECBY17	Wireless sensor Networks
18.	ECBY18	RF System Design
19.	ECBY19	MIMO systems
20.	ECBY20	Cognitive and Co-operative Radio Communications
21.	ECBY21	RF Wireless Systems And Standards
22.	ECBY22	Software Radio Architecture
23.	ECBY23	Soft Computing
24.	ECBY24	Quantum Computing
25.	ECBY25	Error Control Coding
26.	SSB7181	Society, Technology & Sustainability

SEMESTER I

		L	T	P	C
MAB6186	**APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS**	**3**	**1**	**0**	**4**

(Common to M.Tech. Comm. & VLSI)

OBJECTIVES:

- The roots of linear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- To expose the students in applying laplace transform in engineering fields.
- To acquire the knowledge of special functions and their properties.
- To teach about the probability and random variable of the various functions.
- To introduce the concepts of queuing models.

MODULE I LINEAR ALGEBRAIC EQUATIONS AND EIGEN VALUE PROBLEM **7**

System of Equations – Solution by Gauss Elimination, Gauss-Jordon and LU decomposition method – Jacobi, Gauss-Seidal iteration method – Eigen values of a matrix by Jocobi and Power methods.

MODULE II WAVE EQUATION **8**

Solution of initial and boundary value problems-Characteristics-D'Alembert's Solution –Significance of characteristic curves - Laplace transform solution for displacement in a long string – a long string under its weight-Longitudinal vibration of a elastic bar with prescribed force on one end - free vibrations of a string.

MODULE III SPECIAL FUNCTIONS **8**

Bessel's equation - Bessel Functions - Legendre's equation - Legendre polynomials -Rodrigue's formula - Recurrence relations - generating functions and orthogonal property of Bessel function and Legendre Polynomials.

MODULE IV RANDOM VARIABLES **7**

One dimensional Random Variables - Moments and MGF - Binomial, Poisson Geometrical, Uniform, Exponential, Normal and Weibull distributions.

MODULE V TWO DIMENSIONAL RANDOM VARIABLES 7

Two -dimensional Random Variables – Marginal and Conditional distribution – Covariance and Correlation coefficient – Functions of one-dimensional and two - dimensional Random Variables.

MODULE VI QUEUING THEORY 7

Single and Multiple serve Markovian queuing models-Steady state system size probabilities – Little's formula – Customer impatience – Priority quences - M/G/1 queuing system - P-K formula.

Total Hours : 60

TEXT BOOKS:

1. Jain M.K., Iyengar .S.R.K: & Jain.R.K, "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd, Publishers, 2003.
2. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, 2005.
3. Taha H.A, "Operations Research – An Introduction", Prentice Hall of India, 2001.

REFERENCES:

1. Sankara Rao K., "Introduction to Partial Differential Equation", Prentice Hall of India, 1997.
2. Kapur J.N & Saxena. H.C, "Mathematical Statistics", S. Chand & Company Limited, New Delhi, 2003.
3. Gross.D & Harris.C.M, "Fundamentals of Queuing Theory", John Wiley & Sons, 1985.

OUTCOMES:

- Be capable of solving large system of linear equations and eigen value problem of a matrix numerically.
- Acquires the knowledge of special functions and applications of laplace transform.
- Able to solve ordinary differential equations numerically.
- Able to solve wave equation using several techniques.
- Learnt the concepts of random variables and queuing models

ECB6102	ADVANCED RADIATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable the students to update their knowledge on fundamentals of antenna and its characteristics.
- To provide knowledge of antenna arrays synthesis.
- To provide practical exposure on microstrip antenna, reflector antenna and aperture antenna.

MODULE I ANTENNA FUNDAMENTALS **12**

Antenna fundamental parameters, Retarded vector potentials: Heuristic approach and Maxwell's equation approach. Radiation from surface and line current distributions, Fields radiated by an alternating current element and half wave dipole monopole, loop antenna: Total power radiated and radiation resistance. Mobile phone antenna, reciprocity theorem, Broadband antennas and matching techniques: BALUN transformer, polarization states.

MODULE II ARRAY ANTENNA **9**

Linear arrays, Two dimensional uniform array: Phased array, beam scanning, grating lobe, feed network. Pattern multiplication .Linear array synthesis techniques: Binomial, Dolph-Chebyshev distributions, Schelkunoff polynomial method and Fourier transform method.

MODULE III RADIATION FROM APERTURES **9**

Field equivalence principle, Huygens Principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane. Slot antenna, Horn antenna, Reflector antennas, aperture blockage and design consideration.

MODULE IV MICRO STRIP ANTENNA **9**

Radiation from patch: Excitation techniques, Microstrip dipole, Rectangular patch, Circular patch, and Ring antenna. Radiation analysis from cavity model. Input impedance, Microstrip array and feed network. Applications.

MODULE V EMC AND ANTENNA MEASUREMENTS 6

EMC measuring antenna: Log periodic dipole, Biconical, Ridge guide, Multi turn loop antenna. Measurement and instrumentation: Gain, Impedance and antenna factor measurement. Antenna test range Design.

Total Hours: 45

REFERENCES:

1. E.C. Jordan and Balmain, "Electro Magnetic Waves and Radiating Systems", PHI, 1968, Reprint 2003.
2. Constantine A. Ballanis , "Antenna Theory " , John Wiley & Sons, second edition, 2003.
3. John D.Kraus and Ronald J. Marhefka, "Antennas for all applications", 3rd Edition Tata McGraw-Hill Book Company, 2006.
4. John D.Kraus, “Radio Astronomy” McGraw-Hill 1966.

OUTCOMES:

On completion of the course, the students will be able to

- Understand the characteristics of an antenna and its array concept.
- Analyze and design various antennas for real time applications.

ECB6103 MODERN DIGITAL COMMUNICATION TECHNIQUES **L T P C 3 1 0 4**

OBJECTIVES:

To make the student understand

- concepts of coherent and noncoherent communications.
- the effects of communication over band limited and fading channels
- the concepts of various coding and spread spectrum techniques.

MODULE I POWER SPECTRUM AND COMMUNICATION OVER MEMORYLESS CHANNEL **9**

PSD of a Synchronous Data Pulse Stream, Generalized M-ary Markov source, Convolutionaly Coded Modulation and Continuous Phase Modulation. Scalar and Vector communication over Memoryless Channel. Detection criteria.

MODULE II COHERENT AND NON-COHERENT COMMUNICATION **9**

Coherent receivers, Optimum receivers in AWGN. IQ Modulation & Demodulation. Non-coherent receivers in Random Phase and Random Amplitude Channels M-FSK receivers, Rayleigh and Rician channels. Differentially Coherent communication: DPSK, M-PSK, M-DPSK: BER Performance Analysis.

MODULE III COMMUNICATION OVER BANDLIMITED CHANNELS **9**

Characterization of Band Limited channels, Nyquist criterion for Zero ISI, Eye pattern. Demodulation in the presence of ISI and AWGN, Equalization techniques. IQ modulations: QPSK, QAM, QBOM. BER Performance Analysis. Continuous Phase Modulation: CPFM, CPFSK, MSK, OFDM.

MODULE IV BLOCK CODED DIGITAL COMMUNICATION **9**

Architecture and performance of Binary block codes: Orthogonal, Bi- orthogonal and Transorthogonal. Linear block codes, cyclic codes. Shannon's channel coding theorem: Channel capacity, Matched filter. Concepts of Spread spectrum communication.

MODULE V CONVOLUTIONAL CODED DIGITAL COMMUNICATION **9**

Representation of codes using Polynomial, State diagram, Tree diagram, and

Trellis diagram. Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods. Error probability performance for BPSK and Viterbi algorithm. Turbo Coding.

Total Hours: 60

REFERENCES:

1. M.K. Simon, S.M. Hinedi and W.C. Lindsey, “Digital communication techniques; Signaling and Detection”, Prentice Hall India, New Delhi, 2010
2. Simon Haykin, “Digital Communications”, John Wiley and Sons, 2011
3. Wayne Tomasi, “Advanced Electronic Communication Systems”, 4th Edition, Pearson Education Asia.
4. B.P. Lathi “Modern Digital and Analog Communication Systems”, 3rd Edition, Oxford University Press.
5. Andrew J. Viterbi, Jim K. Omura, "Principles of Digital Communication and Coding", McGraw-Hill Inc.1979.
6. Ian Glover, Peter Grant, “Digital Communications”, Prentice Hall, 2003 Edition
7. Bernard Sklar – “Modern Digital Communication Technique – Fundamental & Applications”, Prentice Hall, 2001 Edition.

OUTCOMES:

On completion of the course the student will be knowledgeable in performance analysis of

- various digital modulation techniques.
- digital coding techniques.

ECB6104 ADVANCED DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

To make the student understand

- the use of various transforms in digital signals & systems analysis.
- spectrum estimation of discrete random signals.
- optimum filters & adaptive filters.
- multirate digital signal processing.

MODULE I TRANSFORMS AND THEIR APPLICATIONS 9

Review of Z Transform, Discrete Fourier Transform, Discrete Time Fourier Transform, Discrete Fourier Series. Introduction to Discrete Wavelet Transform. Haar wavelet . Application of transforms to discrete signals.

MODULE II DISCRETE TIME RANDOM PROCESSES AND SPECTRUM ESTIMATION 15

Deterministic process – Stochastic (random) process – Auto correlation & auto covariance of random processes – Cross correlation of random variables – Ergodic random process – Gaussian random process – Stationary & WSS random process – Power spectrum – Parseval's theorem – Wiener-Khintchine theorem – Spectral factorization – Periodogram - Modified periodograms using Bartlett , Welch, Blackman & Tukey windows – AR, MA, ARMA model based spectral estimation – Yule-Walker Equations – Durbin's algorithm.

MODULE III SIGNAL MODELING AND OPTIMUM FILTERS 12

Least square method model – Prony's pole-zero model – Prony's all pole model – Levinson-Durbin's recursion – Lattice filters – Forward & backward linear prediction filters.

MODULE IV ADAPTIVE FILTERS 12

FIR adaptive filters – Steepest descent method - Widrow-Hoff LMS algorithm – Normalized LMS method – Adaptive channel equalization – Adaptive noise cancellation – IIR adaptive filters - RLS filters.

MODULE V MULTIRATE DIGITAL SIGNAL PROCESSING 12

Need for multirate sampling – Decimation – Interpolation - Poly-phase filters – Multistage implementation –Phase shifters – Sub-band coders – Trans-multiplexers – Quadrature mirror filters.

Total Hours: 60

REFERENCES:

1. Monson H.Hayes – Statistical digital signal processing and modeling – John-Wiley & Sons – 2005.
2. John G.Proakis & Dimitris G.Maolakis – DSP principles, algorithms & applications – 4th edition – Pearson Education – 2007.

OUTCOMES:

The students will be able to:

- Estimate the power spectrum of signals
- Design & analyze digital filters based on signal modeling

ECB6101 RESEARCH METHODOLOGY FOR ENGINEERS ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce students to a number of perspectives on research and to broaden their conceptions of what research involves.
- To learn about research, design, information retrieval, problem formulation, use of statistical techniques, evaluation and writing of research reports, papers and ethics in research.

MODULE I RESEARCH PROBLEM FORMULATION 7

Research - objectives - types, Research process, solving engineering problems-Identification of research topic - Formulation of research problem, literature survey and review.

MODULE II RESEARCH DESIGN 8

Research design - meaning and need - basic concepts - Different research designs, Experimental design - principle - important experimental designs, Design of experimental setup, Mathematical modeling - Simulation, validation and experimentation - Dimensional analysis - similitude.

MODULE III USE OF STATISTICAL TOOLS IN RESEARCH 12

Importance of statistics in research - Concept of probability - Popular distributions - Sample design. Hypothesis testing, ANOVA, Design of experiments - Factorial designs - Orthogonal arrays, Multivariate analysis - correlation and regression, Curve fitting.

MODULE IV ANALYSIS AND INTERPRETATION OF DATA 10

Research Data analysis - Interpretation of results - Correlation with scientific facts - repeatability and reproducibility of results - Accuracy and precision - limitations, Use of optimization techniques - Traditional methods – evolutionary optimization techniques.

MODULE V THE RESEARCH REPORT 8

Purpose of written report - Audience - Synopsis writing - preparing papers for International Journals-thesis writing - Organization of contents - style of writing-

graphs and charts - Referencing, Oral presentation and defence - Ethics in research - Patenting, IPR.

Total Hours: 45

REFERENCES:

1. Ganesan.R., "Research methodology for Engineers", MJP Publishers,Chennai,2011
2. Kothari C.R., "Research, Methodology - Method and Techniques". New Age International (P) Ltd., New Delhi, Reprint 2003.
3. Doebelin, Ernest. O., "Engineering Experimentation: planning, execution, reporting"- Tata McGraw - Hill International edition, 1995.
4. Rao S.S. "Engineering Optimization:Theory and Practice", John Wiley & Sons, 2009
5. Dan Jones, "Technical writing style", Pearson Education Company, Massachusetts, 1998.
6. Abdul Rahim R., "Thesis writing: A Manual for Researchers", New Age International (P) Ltd., 2005.

OUTCOMES:

The graduates will have the capability to:

- Plan, undertake, execute research projects and prepare relevant documents
- Take up doctoral research in their area of interest and submit the thesis and defend the same successfully

ECB6105	COMMUNICATION SYSTEM LAB – I	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To get hands on experience on various antenna measurements
- To get exposure to practical problems in optical fiber communication
- To analyze various techniques used in communication through simulation

LIST OF EXPERIMENTS

1. Antenna measurements.
2. Simulation of Modulation techniques in AWGN Communication Channel.
3. Implementation of digital Filters.
4. Performance evaluation of OTDR
5. Study of Spread Spectrum Techniques.
6. Implementation of Linear Codes.
7. Implementation of Cyclic Codes.

OUTCOMES:

On completion of the course, student will be able to

- Make performance analysis of various types of antennas
- Validate their design using simulation tools and test the performance using spectrum analyzer and network analyzer

SEMESTER II

		L	T	P	C
ECB6211	**MOBILE COMMUNICATION NETWORKS**	**3**	**0**	**0**	**3**

OBJECTIVES:

To make the student understand

- the principles used in the design of mobile communications networks.
- the technical issues in the operation and management of mobile communications networks
- the security issues in wireless networks

MODULE I INTRODUCTION TO MOBILE NETWORKS 12

Operation of first, second and third generation wireless networks: cellular systems, medium access techniques, Cellular Telephony Channel Division Techniques (TDMA, FDMA, CDMA), Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Improving Coverage and Capacity in Cellular Networks.

MODULE II MOBILE NETWORK ARCHITECTURE 12

GSM General Architecture, Location tracking and call set up, security, data services, GSM network signaling, SS7, Key Role of Signaling Interfaces and Network Entities relation. The Physical and Logical Channels, Terminal, Call and Network Management Procedures, Network Planning.

MODULE III WIRELESS LOCAL AREA NETWORKS 10

Introduction to WLAN, General Characteristics of the Hyper LAN System, 802.11 and 802.11a Standards, Mobile Ad Hoc Networks, Wireless Sensor Networks: Architecture and Routing Protocols.

MODULE IV SECURITY ISSUES IN WIRELESS NETWORKS 11

Security in Wireless Networks, Key Management: Diffie Hellman Key Exchange, Message Authentication and Hash Function. Hash Algorithms: Message Digest Algorithms, Secure Hash Algorithm, HMAC; IP Security.

Total Hours: 45

REFERENCES:

1. William Stallings, "Wireless Communications and Networks", Prentice Hall, 2002.
2. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall, 2002.
3. Leon-Garcia and I. Widjaja, "Communication Networks, Fundamental Concepts and Key Architectures", McGraw-Hill, 2000.
4. J.Schiller,"Mobile Communications", Addison Wesley, 2000.
5. Yi-Bang Lin, Imrich Chlamtac, "Wireless and mobile network architectures", Wiley India, 2011.
6. Holger Karl, Andreas Willig, " Protocols and Architectures for Wireless Sensor Networks" Wiley 2012.
7. William Stallings, "Cryptography and Network Security", Pearson Education, 2004.

OUTCOMES:

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

- the architecture of mobile communication networks,
- characteristics of wireless LAN systems and
- security algorithms used in wireless networks

ECB6212 SATELLITE COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

To understand

- the concept of satellite communications
- satellite launching, related control and space subsystems
- the fundamentals of space link design, multiple access techniques and applications

MODULE I ORBITAL MECHANICS 9

Kepler's laws, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements: Look Angle Determination and Visibility. Orbital Perturbations, Orbit Determination, Orbital Effects in Communication System. Satellite launch and launch vehicle. Spectrum allocations for satellite systems.

MODULE II SPACECRAFT SUBSYSTEMS AND EARTH STATION 9

Spacecraft Subsystems, Attitude and Orbit Control, Telemetry and Tracking, Power Systems, Communication Subsystems, Transponders, Antennas, Equipment Reliability and Earth Stations.

MODULE III SPACE LINKS 9

Basic Transmission Theory, System Noise Temperature, G/T Ratio, Noise Figure, Satellite Link Design : uplink and downlink power Budget, Design of Satellite Links for Specified C/N. Propagation on Satellite-Earth Paths. Propagation effects and its elimination.

MODULE IV MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS 9

Single access vs Multiple access, Multiple access techniques, Estimating channel requirements, Random access, Multiple access with On-board processing, Practical demand access systems. Mobile satellite networks, Hybrid satellite- terrestrial networks.

MODULE V APPLICATIONS AND SERVICES 9

Advanced applications based on satellite platforms , INTELSAT series, INSAT, VSAT, Remote Sensing, Satellite Mobile services: GSM, GPS, INMARSAT, Direct to Home service. Special services: E-mail, Video conferencing and Internet connectivity.

Total Hours: 45

REFERENCES:

1. Timothy Pratt,Charles Bostian & Jeremy Allmuti,Satellite Communications, John Wiley & Sons (Asia) Pvt. Ltd., 2004
2. Dennis Roddy, "Satellite Communications", Third Edition, Mc Graw Hill International Editions, 2001
3. Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, New York, 1990.
4. Wilbur L.Pritchard, Hendri G.Suyderhood, Robert A.Nelson,"Satellite Communication Systems Engineering", II Edition, Prentice Hall, New Jersey, 1993.
5. Bruce R.Elbert, "The Satellite Communication Applications Hand Book, Artech House Boston, 1997.

OUTCOME:

- On completion of the course the student will acquire knowledge in various aspects of a communication satellite and also about other applications of satellite technology.

ECB6213 MICROWAVE INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To study the different technologies of microwave integrated circuits along with the design and analysis of micro-strip lines.

MODULE I TECHNOLOGY OF HYBRID MICs **7**

Dielectric substrates: thick, thin film technology and materials, method of testing, encapsulation of devices for MICs and mounting of active devices.

MODULE II TECHNOLOGY OF MONOLITHIC MICs **7**

Processes involved in fabrication, epitaxial growth of semiconductor layer, growth of dielectric layer, diffusion ion implantation, electron beam technology.

MODULE III ANALYSIS OF MICROSTRIP LINES **11**

Characteristics of conventional transmission structures, Characteristics of planar transmission lines: strip line, micro strip, suspended and inverted micro strip lines, slot line and coplanar lines. Comparison of various MIC transmission media, coupled line and discontinuities.

MODULE IV ANALYSIS OF COUPLED MICROSTRIP **11**

Basic properties of dividers and couplers, three port networks, four port networks T junction power dividers, even and odd mode analysis, waveguide directional couplers, Bethe hole coupler, design of multihole couplers, quadrature hybrid. Design of coupled line directional couplers and 180^0 degree hybrid.

MODULE V LUMPED ELEMENTS AND NON-RECIPROCAL COMPONENTS **9**

Design of lumped elements: inductors, capacitors and resistors. Ferromagnetic substrate for non-reciprocal devices: microstrip and latching circulators, isolators and phase shifters.

Total Hours : 45

REFERENCES:

1. I.J.Bhal and P.Bhartia, “Microwave solid state circuit design”, John Wiley & sons, 2003.
2. David M.Pozar, “Microwave Engineering”, John Wiley & sons, 1998
3. Hoffman, R.K- “Handbook of Microwave Integrated Circuits”- Artech House, 1987
4. S.Y.Liao, “Microwave Circuit Analysis and Amplifier Design”, Prentice Hall, 1987.
5. Gupta.K.C and Amarjit Singh, “Microwave Integrated Circuits”- John Wiley & sons-Wiley Eastern Reprint, 1978.

OUTCOMES:

The student will acquire knowledge in

- the fabrication and operation of microwave devices.
- the different types of MICs
- the design and analysis of microstrip line.
- the design and analysis of non reciprocal components and active devices.

ECB6214 MULTIMEDIA COMPRESSION TECHNIQUES **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the need for multimedia compression techniques
- To study the various types of text, audio, image and video compression techniques, standards and applications.

MODULE I INTRODUCTION **9**

Special features of Multimedia – Graphics and Image Data Representations - Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

MODULE II TEXT COMPRESSION **9**

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

MODULE III AUDIO COMPRESSION **9**

Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.

MODULE IV IMAGE COMPRESSION **9**

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

MODULE V VIDEO COMPRESSION **9**

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and

compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

Total Hours : 45

REFERENCES:

1. Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
3. Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
4. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
5. Mark Nelson : Data compression, BPB Publishers, New Delhi,1998.
6. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.

OUTCOMES:

On completion of this course the students are expected to

- Understand and apply various compression techniques
- Be familiar with various standards of text, audio, image and video compression Techniques

ECB6215 COMMUNICATION SYSTEM LAB – II

L	T	P	C
0	0	3	1

OBJECTIVES:

To get an exposure on the practical aspects of

- Audio, speech and image compression algorithms
- RF and microwave devices and their properties
- Performance analysis of CDMA systems
- Applications of GPS

LIST OF EXPERIMENTS

1. Simulation of Audio and speech compression algorithms
2. Simulation of Image compression algorithms.
3. Simulation of Microstrip Antennas
4. S-parameter estimation of Microwave devices.
5. Study of Global Positioning System.
6. Performance evaluation of CDMA System.
7. Design and testing of a Microstrip coupler.
8. Simulation of OFDM

OUTCOMES:

On completion of the course students will be

- able to use simulation tools to design and validate their compression algorithms and antenna designs.
- competent in CDMA techniques, GPS application and OFDM

ECB6216	DESIGN / FABRICATION PROJECT	L	T	P	C
		0	0	3	1

OBJECTIVES :

To improve the professional competency and research aptitude by performing design and fabrication project. This design skill will help the students to develop the work practice to apply the design skills for real life problems.

The project can be a experimental project on any of the topics in electronics design related topics. The project work is allotted individually on different topics. The students shall be encouraged to do their project in the parent institute itself. Department will constitute an Evaluation Committee to review the project.

OUTCOMES:

At the end of the project the student will be able to design and fabricate the hardware.

SEMESTER-III

ECB7102 PROJECT MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to provide knowledge to students about the stages of a project and how each stage can be effectively managed and to impart design considerations of safety organization and control.

MODULE I **9**

Project definition, Project Profile and standards, Feed back information (MIS), Evaluation and Modification, Selection, Criteria.

MODULE II **9**

Planning the process, Strategic and Managerial Planning, Organising the process planning, cost and costing, Cost Control systems, Economic Balancing, Network Planning, Methods (PERT/CPM), Engineering Flow Diagrams, Cost requirements, Analysis and Estimation of Process Feasibilities (Technical/Economical) Analysis, Cost – Benefit Ratio Analysis, Project Budgeting, Capital Requirements, capital Market, Cash Flow Analysis, Break even strategies.

MODULE III **9**

Plant Engineering Management, Objectives, Programme, Control, Plant Location and Site Selection, Layout diagrams, Selection and procurement of equipment and machineries, Installation, Recommission, Commissioning and performance appraisal, Strategies choice and Influence, Product planning and development, Provision and maintenance of service facilities.

MODULE IV **9**

Process safety, Materials safety and Handling regulations, Safety in equipment and machinery operations, Design considerations of safety organization and control, Pollution, Pollution control and Abatement, Industrial Safety Standard Analysis.

MODULE V **9**

Government regulations on procurement of raw materials and its allocation. Export – Import regulations, Pricing policy, Industrial licensing procedure, Excise and other commercial taxes, Policies on depreciation and corporate tax, Labour laws, Social welfare legal measurements, Factory act, Regulations of Pollution Control Board.

Total Hours : 45

REFERENCES:

1. Cheremisinoff, N. P., Practical Guide to Industrial Safety: Methods for Process Safety Professionals, CRC Press, 2001
2. Couper, J. R., Process Engineering Economics, CRC Press, 2003.
3. Perry, J. H. “Chemical Engineer’s Hand Book”, 8th Ed., McGraw Hill, New York, 2007.
4. Peters, M. S., Timmerhaus, C. D. and West, R. E., “Plant Design and Economics for Chemical Engineers”, 5th Edn., McGraw Hill, 2003.
5. Silla, H., Chemical Process Engineering: Design and Economics, CRC Press, 2003.
6. Vinoski, W., Plant Management Handbook, Pearson Education, Limited, 1998
7. Watermeyer, P., Handbook for Process Plant Project Engineers, John Wiley and Sons, 2002.

OUTCOMES:

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

- identify key components of a project
- describe the stages of a project and how each stage can be effectively managed.
- learn Design considerations of safety organization and control
- learn government regulations on procuring raw materials.

ELECTIVES

ECBY01 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

To study & to understand

- the concepts of image processing and related transforms.
- the image processing techniques for enhancement, restoration and compression.

MODULE I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Basics of visual perception, Psycho, visual model, Color image fundamentals, Brightness, contrast, hue, saturation, GB,HSI models, Image sampling & quantization.

MODULE II IMAGE TRANSFORMS 9

2D discrete transforms, DFT, DCT, WHT, KLT, DWT, Simulation of 2D transform by 1D transform.

MODULE III IMAGE ENHANCEMENT AND RESTORATION 9

Histogram modification and specification techniques, Noise distributions, Spatial averaging , Directional Smoothing, Median, Geometric mean, Harmonic Mean, Homomorphic filtering, Color image enhancement, Image degradation model – Unconstrained and constrained restoration, Inverse filtering, Removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations, Spatial transformations, Gray level interpolation.

MODULE IV IMAGE SEGMENTATION AND RECOGNITION 9

Edge detection, Image segmentation by region growing, region splitting & merging and edge linking, Image Recognition, Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Neural Network applications in image processing.

MODULE V IMAGE COMPRESSION 9

Need for image compression, Vector Quantization, Run Length Encoding, Shift

codes Block Truncation Coding. DCT and Wavelet Transform coding, JPEG, MPEG Standards.

Total Hours : 45

REFERENCES:

1. Rafael 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, 2002.
3. David Salomon : Data Compression The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001
4. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 2004.
5. William K.Pratt, Digital Image Processing, John Wiley, NewYork, 2002

OUTCOME:

- On completion, the students will be knowledgeable in the mathematical representation of images and digital image image processing methods.

ECBY02	SIMULATION OF COMMUNICATION SYSTEMS & NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study about modeling of signals and the channel modeling in depth
- To study the mathematical analysis of modeling
- To understand the concept of communication networks in terms of modeling
- To study the routing model for any communication network

MODULE I MODELLING OF COMMUNICATION SYSTEM 9

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system models.

MODULE II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS 9

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov and ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers.

MODULE III ESTIMATION OF PERFORMANCE MEASURES 9

Quality of an estimator, estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, Monte Carlo method and Importance of sampling method, Estimation of power spectral density.

MODULE IV COMMUNICATION NETWORKS 9

Queuing models, M/M/1 and M/M/m queues, Little formula, Burke's theorem, M/G/1 queue, Embedded Markov chain analysis of TDM systems, Polling, Random access systems.

MODULE V NETWORK OF QUEUES 9

Queues in tandem, Store and forward communication networks, Capacity

allocation, Congestion and flow chart, Routing model, Network layout and Reliability.

Total Hours : 45

REFERENCES:

1. M.C.Jeruchim,Philip Balaban and K.Sam Shanmugam, "Simulation of communication systems", Plenum Press, New York,1992
2. A.M.Law and W.David Kelton, "Simulation Modelling and analysis", Mc Graw Hill Inc., New York ,1991
3. J.F.Hayes, “Modelling and Analysis of Computer Communication networks”, Plenum Press, New York,1984
4. Jerry Banks and John S.Carson, “Discrete-event System Simulation”, Prentice Hall Inc., New Jersey,1984
5. MC. Jeruchim, P.Balaban, S.Shanmugam, “Simulation of Communication systems- Modelling methodology and techniques”, Plenum publication, 2000.

OUTCOMES:

At the end of the course the student will be aware of

- Different modeling methods of channel
- Channel property by mathematical and estimation methods.

ECBY03 GLOBAL TRACKING AND POSITIONING SYSTEMS **L T P C**
3 0 0 3

OBJECTIVES:

- To know about history of GPS and various existing GPS Systems
- To learn about US based GPS System Segments
- To learn about various functionalities and techniques used in GPS
- To know about hindrances caused for GPS
- To acquire knowledge about various applications of GPS in various fields

MODULE I INTRODUCTION TO TRACKING AND GPS SYSTEM **9**

Basic concepts of GPS. Space segment, Control segment, user segment, History of GPS constellation, GPS measurement characteristics, selective availability(AS), ant spoofing (AS), GPS aided Geo-augmented navigation (GAGAN) architecture. Applications of Satellite and GPS for 3D position, Velocity, determination as function of time, Interdisciplinary application (eg,.Crystal dynamics, gravity field mapping, reference frame, atmospheric occultation)

MODULE II ORBITS AND REFERENCE SYSTEMS **9**

Basics of satellite orbits and reference systems-Two-body problem, orbit elements, time system and time transfer using GPS, coordinate systems, GPS Orbit design, orbit determination problem, tracking networks, GPS force and measurement models for orbit determination, orbit broadcast ephemeris, precise GPS ephemeris, Tracking problems

MODULE III GPS MEASUREMENTS **9**

GPS Observable-Measurement types (C/A Code, P-code, L1 and L2 frequencies for navigation, pseudo ranges), atmospheric delays(tropospheric and ionospheric), data format (RINEX), data combination (narrow/wide lane combinations, ionosphere-free combinations single, double, triple differences), undifferenced models, carrier phase Vs Integrated Doppler, integer biases, cycle slips, clock error.

MODULE IV PROCESSING TECHNIQUES 9

Pseudo range and carrier phase processing, ambiguity removal, Least square methods for state parameter determination, relation positioning, dilution of precision.

MODULE V OTHER CONSTELLATIONS AND AUGMENTATION SYSTEMS 9

Other satellite navigation constellations GLONASS and Galileo IRNS System. Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS. Local area augmentation system (LAAS) concept.

Total Hours : 45

REFERENCES:

1. B.Hoffman Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 5th edition, Springer Wein, New york,2001
2. A.Leick, "GPS Satellites Surveying", 3rd edition, John Wiley & Sons,NewYork,2003
3. A.Kleusberg and P.Teunisen(Eds), “GPS for Geodesy”, Springer-Verlag, Berlin,1996
4. G.S.Rao,”Global Navigation Satellite Systems”, McGraw-Hill Publications, New Delhi, 2010
5. Ahmed El-Rabbany, “Introduction to GPS,” Artech House, Boston, 2002.

OUTCOMES:

On completion of this course the student will understand

- the concept of satellites orbits
- various functionalities and techniques used in GPS
- application of GPS

ECBY04 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of electromagnetic interference coupling principles and control techniques
- To learn electromagnetic compatibility design of PCBS
- To learn electromagnetic interference measurements and standards

MODULE I EMI ENVIRONMENT **7**

EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

MODULE II EMI COUPLING PRINCIPLES **8**

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

MODULE III EMI/EMC STANDARDS AND MEASUREMENTS **10**

Civilian standards, FCC, CISPR, IEC, EN, Military standards : MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell - Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method

MODULE IV EMI CONTROL TECHNIQUES **10**

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

MODULE V EMC DESIGN OF PCBs **10**

PCB Traces, Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

Total Hours : 45

REFERENCES:

1. Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, NewYork. 1988.
2. C.R.Paul, “Introduction to Electromagnetic Compatibility” , John Wiley and Sons, Inc, 1992
3. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.
4. Bernhard Keiser, "Principles of Electromagnetic Compatibility", Artech house, 3rd Ed, 1986.
5. R.Paul, “Introduction to EMC” Wiley 2006 2nd edition.

OUTCOMES:

On completion of this course the student will know about:

- EMI Coupling Principles.
- EMI Specification, Standards and Limits.
- EMI Measurements and Control Techniques.
- EMC Design of PCBs.

ECBY05 HIGH PERFORMANCE COMMUNICATION NETWORKS **L T P C 3 0 0 3**

OBJECTIVES:

- To introduce various high speed network architectures and protocols
- To study about various advanced network architecture
- To introduce the fundamentals of Bluetooth technology

MODULE I PACKET SWITCHED NETWORKS **9**

OSI and IP models, Ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN (IEEE 802.11) FDDI, DQDB, SMDS: Internetworking with SMDS

MODULE II ISDN AND BROADBAND ISDN` **9**

ISDN, Overview, Interfaces and functions, Layers and services, Signaling System 7, Broadband ISDN architecture and Protocols.

MODULE III ATM AND FRAME RELAY **9**

ATM: Main features-Addressing, Signaling and Routing, ATM header structure-Adaptation layer, management and control, ATM switching and transmission.

Frame Relay: Protocols and services, Congestion control, Internetworking with ATM, Internet and ATM, Frame relay via ATM.

MODULE IV ADVANCED NETWORK ARCHITECTURE **9**

IP forwarding architectures overlay model, Multi Protocol Label Switching, Integrated services in the Internet, Resource Reservation Protocol, Differentiated services

MODULE V BLUE TOOTH TECHNOLOGY **9**

The Blue tooth module-Protocol stack, The Link Manager, Link Setup, LMP link shutdown, Quality of Service,The Host controller interface, HCI packet type, HCI transport layer, Flow control, Configuring Model, Inquiry, Paging, Page scan, Power Control, Logical link control and adaptation protocol.

Total Hours : 45

REFERENCES:

1. William Stallings, “ISDN and Broadband ISDN with Frame Relay and ATM”, 4th edition, Pearson education Asia, 2002.
2. Leon Gracia, Widjaja, “Communication networks”, Tata McGraw-Hill, New Delhi, 2000.
3. Jennifer Bray and Charles F.Sturman, “Blue Tooth”, Pearson education Asia, 2001.
4. Sumit Kasera, Pankaj Sethi, “ATM Networks”, Tata McGraw-Hill, New Delhi, 2000.
5. Rainer Handel, Manfred N.Huber and Stefan Schroder, “ATM Networks”, 3rd edition, Pearson education asia, 2002.
6. Jean Walrand and Pravin Varaiya, “High Performance Communication Networks”, 2nd edition, Harcourt and Morgan Kauffman, London, 2000.
7. William Stallings, “High-speed Networks and Internets”, 2nd edition, Pearson education Asia, 2003.

OUTCOME:

- At the end of the course student will gain knowledge about various advanced network architectures, protocols, Bluetooth technology and will be able to understand real time network architectures.

ECBY06 DIGITAL COMMUNICATION RECEIVERS

L	T	P	C
3	0	0	3

OBJECTIVE:

- The purpose of this course is to develop a strong foundation in the digital receivers. This subject explains the underlying principles in the Digital Communication receivers. Students are exposed to AWGN and fading channels. Important functions like synchronization and equalization are explained.

MODULE I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9

Base band and band pass communication, signal space representation, linear and non- linear modulation techniques, and spectral characteristics of digital modulation.

MODULE II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9

Correlation demodulator, matched filter, maximum likelihood sequence detector, Optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-ary and correlated binary signals.

MODULE III RECEIVERS FOR FADING CHANNELS 9

Characterization of fading multiple channels, statistical models, slow fading, frequency selective fading, diversity technique, RAKE demodulator, coded waveform for fading channel.

MODULE IV SYNCHRONIZATION TECHNIQUES 9

Carrier and symbol synchronization, carrier phase estimation, PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

MODULE V ADAPTIVE EQUALIZATION 9

Zero forcing algorithm, LMS algorithm, Adaptive decision feedback equalizer, and equalization of Trellis-coded signals, Kalman algorithm, blind equalizers, and stochastic gradient algorithm.

Total Hours : 45

REFERENCES:

1. Heinrich Meyr, Mare Moeneclacy and Stefan.A. Fechtel, “Digital Communication Receivers”, Vol I & II, John Wiley, New York, 1997
2. John. G. Proakis, “Digital Communication”, 4th ed., McGraw Hill, New York, 2001
3. E.A. Lee and D.G. Messerschmitt, “Digital Communication”, 2nd edition, Allied Publishers, New Delhi, 1994
4. Simon Marvin, “Digital Communication Over Fading channel; An unified approach to performance Analysis”, John Wiley, New York, 2000
5. Bernard Sklar, “Digital Communication Fundamentals and Applications, Prentice Hall,1998

OUTCOMES:

At the end of this course students will have the knowledge on

- Linear and nonlinear modulation techniques
- Various channels like AWGN and fading
- Synchronization techniques
- Adaptive equalization techniques

ECBY07 OPTICAL COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on

- optical technology and network components for Optical communication.
- various network architecture and topologies for optical networks.
- the issues in the network design and operation for wavelength routing in optical networks.

MODULE I OPTICAL TECHNOLOGY **6**

Light Propagation in optical fiber, Non linear effects, subcarrier modulation and multiplexing, spectral efficiency, Demodulation, error detection and correction.

MODULE II OPTICAL NETWORKING COMPONENTS **7**

First- and second-generation optical networks, Components: couplers, isolators, circulators, multiplexers, filters, amplifiers, switches, and wavelength converters.

MODULE III SONET AND SDH NETWORKS **7**

Integration of TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network elements, Topologies, Protection architectures, Ring architectures, Network Management.

MODULE IV BROADCAST AND SELECT NETWORKS **8**

Topologies, Single-hop, Multihop, and Shufflenet multihop networks, Media-Access control protocols, Test beds.

MODULE V WAVELENGTH-ROUTING NETWORKS **8**

Node designs, Issues in Network design and operation, Optical layer cost Tradeoffs, Routing andWavelength assignment, Wavelength routing test beds.

MODULE VI HIGH CAPACITY NETWORKS **9**

SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks:

Multiplexing and demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM test beds.

Total Hours : 45

REFERENCES:

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, Morgan Kaufmann, 2nd edition, 2001.
2. Vivek Alwayn, Optical Network Design and Implementation, Pearson Education, 2004.
3. Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers, 2002.
4. Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997.

OUTCOMES:

On completion of this course the student will understand

- the optical networking components.
- the architecture of SONET/SDH and network elements.
- the wavelength routing networks.

ECBY08 ADVANCED MICROWAVE SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

The objective of the course is to develop a clear understanding of the basic principles and advanced applications of Microwave Engineering, as well as different amplifier design, oscillators design, and mixers.

MODULE I ELECTROMAGNETIC AND TRANSMISSION LINES THEORY 7

Introduction to microwave Engineering, Maxewell's Equations, Fields in media and boundary conditions, wave equations and basic plane wave solutions. Lumped element circuit model for a transmission line, field analysis of a transmission lines, terminated lossless transmission lines, smith chart, quarter wave transformers, generator and load mismatches, lossy transmission lines.

MODULE II TRANSMISSION LINES AND WAVEGUIDES 7

General solutions for TEM, TE and TM waves, Parallel plate, rectangular, circular waveguide, Coax line, surface waves on a grounded dielectric shield, strip line, microstrip line.

MODULE III MICROWAVE NETWORK ANALYSIS, IMPEDANCE MATCHING AND TUNING 8

Impedance and equivalent voltages and currents, impedance and admittance matrices, scattering matrices, ABCD matrix, Signal flow graphs, discontinuities and modal analysis, excitation of waveguides-electric and magnetic currents, aperture coupling. Matching with lumped elements, single stub, double stub tuning, quarter wave transformer.

MODULE IV MICROWAVE RESONATORS 8

Series and parallel resonance circuits, transmission line resonators, rectangular waveguide cavity resonator, circular waveguide cavity resonator, dielectric resonator, excitation of resonator, cavity perturbation.

MODULE V MICROWAVE FILTERS 8

Periodic structures, filter design by: Image parameter method, insertion loss method, filter transformation, filter implementation, LPF, coupled line filters, filters using coupled resonators

MODULE VI MICROWAVE AMPLIFIER, OSCILLATOR AND MIXER DESIGN7

Two port power gains, stability, single stage transistor amplifier design, broadband transistor amplifier design, power amplifier, RF oscillators, Microwave Oscillator, oscillator phase noise, frequency multipliers, mixers.

Total Hours : 45

REFERENCES:

1. R.E.Collin, “Foundations of Microwave Engineering”, McGraw-Hill, 1992.
2. Ramo, Whinnery and Van Duzer, “Fields and Waves in Communication Electronics”, 3rd Edition, Wiley, 1997
3. David .M Pozar “Microwave and RF System Design” Wiley 2001 Edition.
4. Wayne Tomasi, “Advanced Microwave Communication Systems” PHI 2002, 2nd Edition.

OUTCOMES:

The course ensures that students acquire the following educational outcomes:

- Mastery of the underlying principles of microwave theory.
- Use of microwave theory concepts to design microwave devices satisfying a given set of specifications and to predict their behavior.
- Mastery of the use of microwave equipment such as network and spectrum analyzers.

ECBY09 SPEECH AND AUDIO SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVE:

- The students will learn how basic digital audio algorithms work, the operation of the processors and the way in which these processes effect sound.

MODULE I INTRODUCTION **5**

Sources, propagation and environmental characteristics, audio sources, sampling, quantizing and compression. Human speech and hearing: speech generation, speech signal characteristics, the hearing system, hearing characteristics.

MODULE II MECHANICS OF SPEECH **7**

Speech production mechanism, Nature of Speech signal, Discrete time modelling of Speech production, Representation of Speech signals, Classification of Speech Sounds, Phones, Phonemes, Phonetic and Phonemic alphabets, Articulatory features. Music production, Auditory perception, Anatomical pathways from the ear to the perception of sound, Peripheral auditory system, Psycho acoustics.

MODULE III TIME DOMAIN METHODS FOR SPEECH PROCESSING **7**

Time domain parameters of Speech signal, Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate, Silence Discrimination using ZCR and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function.

MODULE IV FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING **8**

Short Time Fourier analysis, Filter bank analysis, Formant extraction, Pitch Extraction, Analysis by Synthesis, Analysis synthesis systems, Phase vocoder, Channel Vocoder. omomorphic Speech Analysis: Cepstral analysis of Speech, Formant and Pitch Estimation – Homomorphic Vocoders.

MODULE V LINEAR PREDICTIVE ANALYSIS OF SPEECH **9**

Formulation of Linear Prediction problem in Time Domain, Basic Principle, Autocorrelation method, Covariance method, Solution of LPC equations,

Cholesky method, Durbin's Recursive algorithm, lattice formation and solutions, Comparison of different methods, Application of LPC parameters, Pitch detection using LPC parameters, Formant analysis, VELP, CELP.

MODULE VI APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING **9**

Algorithms: Dynamic time warping, K-means clustering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition: Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification, Voice response system, Speech synthesis: basics of articulatory, source-filter, and concatenative synthesis, VOIP.

Total Hours : 45

REFERENCES:

1. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc., 2004.
2. L.R.Rabiner and R.W.Schaffer, "Digital Processing of Speech signals", Prentice Hall 1978.
3. Quatieri, "Discrete-time Speech Signal Processing", Prentice Hall , 2001.
4. J.L.Flanagan, "Speech analysis: Synthesis and Perception", Springer- Verlag, Berlin.
5. I.H.Witten, "Principles of Computer Speech", Academic Press, 1982.

OUTCOMES:

The student will acquire knowledge in

- Manipulate, visualize and analyze speech signals
- Various decomposition and modification of speech signals.

ECBY10 NETWORK SECURITY L T P C
3 0 0 3

OBJECTIVES:

- Familiarity with the major algorithms of historical and modern cryptography as documented in open literature
- knowledge of issues involved in choice of algorithm and key size
- ability to analyze performance of various cryptographic and cryptanalytic algorithms

MODULE I SYMMETRIC CIPHERS (TECHNIQUES AND STANDARDS) –I 9

Introduction – Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Stegnography; Block Ciphers and Data Encryption Standard- Simplified DES, Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

MODULE II SYMMETRIC CIPHERS (TECHNIQUES AND STANDARDS) – II 9

Advanced Encryption Standard- Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher; Confidentiality using Symmetric Encryption- Placement of Encryption Function, Traffic Confidentiality, Key Distribution, and Random Number Generation.

MODULE III PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS 9

Public Key Cryptography and RSA- Principles of Public Key Cryptosystems, RSA Algorithm; Key Management and other public key cryptosystems- Key Management, Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions- Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions and MACs; Hash Algorithms- MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC;

Digital Signatures and Authentication Protocols - Digital Signatures, Authentication Protocols, Digital Signature Standards.

MODULE IV NETWORK SECURITY PRACTICE 9

Authentication Applications- Kerberos, X.509 Authentication Service; Electronic Mail Security- Pretty Good Privacy, S/MIME; IP Security- IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations; Web Security- Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

MODULE V SYSTEM SECURITY 9

Intruders- Intruder Detection, Password Management; Malicious Software- Virus and Related Threats, Virus Counter Measures; Firewalls- Firewall Design Principles, Trusted Systems.

Total Hours : 45

REFERENCES:

1. William Stallings, “Cryptography and Network Security”, 3rd edition. Prentice Hall of India, New Delhi, 2004.
2. William Stallings, “Network Security Essentials”, 2rd edition. Prentice Hall of India, New Delhi, 2004.
3. Charlie Kaufman , “Network Security: Private Communication in Public World”, 2nd edition. Prentice Hall of India, New Delhi, 2004.

OUTCOMES:

On completion of the course the student will understand the

- methods of conventional encryption.
- concepts of public key encryption and number theory
- authentication and Hash functions.
- network security tools and applications.
- system level security used.

ECBY11	WIRELESS COMMUNICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on wireless channels, capacity and propagation models
- To introduce MIMO systems, multiuser system, OFDM and broadband modulation
- To impart knowledge on multiple access techniques.

MODULE I INTRODUCTION **7**

Wireless spectrum and allocation, radio propagation models, path loss calculation, ray tracing methods, empirical path loss models, discrete time and space time statistical channel models.

MODULE II CAPACITY AND DIVERSITY OF WIRELESS CHANNELS **7**

Capacity in AWGN, capacity of flat fading channels, capacity of frequency selective fading channels, Receiver Diversity & Transmitter Diversity techniques.

MODULE III MULTIPLE ANTENNA SYSTEMS **8**

Narrow band MIMO model, MIMO channel capacity, MIMO Diversity and beam forming, diversity multiplexing tradeoff, space time modulation and coding, frequency selective fading MIMO channels, smart antennas.

MODULE IV MULTI CARRIER MODULATION **8**

Data transmission using multiple carriers, Multi carrier modulation with overlapping subchannels. Mitigation of subcarrier fading, Discrete implementation of multicarrier systems, matrix representation of OFDM, PAPR.

MODULE V SPREADSPECTRUM **7**

Spread spectrum principle – DSSS – FHSS, multiuser DSSS – spreading codes, downlink and uplink channels, multicarrier CDMA system and multi user FHSS systems.

MODULE VI MULTIPLE ACCESS AND MULTI USER MIMO SYSTEMS 8

Multiple access Techniques – hybrid spread spectrum techniques – SDMA – Multiuser MIMO model – channel capacity – Transmission methods for broadcast channel.

Total Hours : 45

REFERENCES:

1. Andrea Goldsmith, “Wireless Communication”, Cambridge Univ. Press, 2006.
2. Theodore S.Rappaport., “Wireless Communications”, 2nd edition, Pearson Education, 2002.
3. Richard Van Nee & Ramjee Prasad., “OFDM for Multimedia Communications” Artech House Publication,2001.
4. Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung G Kang “MIMO – OFDM Wireless Communications with MATLAB”, IEEE press, John Wiley publications, 2010.

OUTCOMES:

On completion of this course the student would be knowledgeable on

- Current wireless systems and PHY layer issues.
- Wireless channels and models
- Broadband modulation schemes
- Multiuser systems and multiple access techniques.

ECBY12 MEDICAL IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To gain fundamental idea on image representation, preprocessing, analysis, classification, reconstruction, registration and visualization of medical images.
- To show how to extract, model, and analyze information from medical data and applications in order to help diagnosis, treatment and monitoring of diseases through computer science.

MODULE I IMAGE FUNDAMENTALS 9

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms.

MODULE II IMAGE PREPROCESSING 9

Image enhancement, point operation, Histogram modeling, spatial operations, Transform operations, Image restoration, Image degradation model, Inverse and Weiner filtering. Image Compression, Spatial and Transform methods.

MODULE III MEDICAL IMAGE RECONSTRUCTION 9

Mathematical preliminaries and basic reconstruction methods, Image reconstruction in CT scanners, MRI, functional MRI, Ultra sound imaging, 3D Ultra sound imaging Nuclear Medicine Imaging Modalities-SPECT, PET, Molecular Imaging.

MODULE IV IMAGE ANALYSIS AND CLASSIFICATION 9

Image segmentation: pixel based, edge based, region based segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification : Statistical, Rule based, Neural Network approaches.

MODULE V IMAGE REGISTRATIONS AND VISUALIZATION 9

Rigid body visualization: Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration,

Image visualization: 2D display methods, 3D display methods, virtual reality based interactive visualization.

Total Hours : 45

REFERENCES:

1. Atam P.Dhawan, “Medical Image Analysis”, Wiley Interscience Publication, NJ, USA 2003.
2. R.C.Gonzalez and R.E.Woods, “Digital Image Processing”, Second Edition, Pearson Education, 2002.
3. Anil. K. Jain, “Fundamentals of Digital Image Processing”, Pearson education, Indian Reprint 2003.
4. Alfred Horowitz, “MRI Physics for Radiologists – A Visual Approach”, Second edition Springer Verlag Network, 1991.
5. Kavyan Najarian and Robert Splerstor, “Biomedical signals and Image processing”, CRC, Taylor and Francis,New York, 2006.
6. John L.Semmlow, “Biosignal and Biomedical Image Processing Matlab Based applications”, Marcel Dekker Inc., New York, 2004.
7. Jerry L. Prince and Jonathan M.Links, “Medical Imaging Signals and Systems”, Pearson Education Inc. 2006.

OUTCOMES:

On completion of the course the student will be able to

- extract, model, and analyze information from medical data
- help diagnosis, treatment and monitoring of diseases through computer science.

ECBY13 NETWORK MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the fundamental concepts of network management
- To have an exposure to network security aspects
- To understand about the architecture, standard and services of broadband networks.

MODULE I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY 9

Network Topology, LAN, Networks node components : Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN : Transmission technology, Communication Protocols and standards.

MODULE II OSI NETWORK MANAGEMENT 9

OSI Network Management Model: Organizational model, Information Model, Communication model. Abstract Syntax notation : Encoding structure, Macros Functional model CMIP / CMIS.

MODULE III INTERNET MANAGEMENT 9

SMMO: Organization model, System overview, the information model, communication model, Functional model, SNMP Proxy server, Management information and Protocol remote monitoring.

MODULE IV BROADBAND NETWORK MANAGEMENT 9

Broadband networks and services, ATM Technology: VP, VC, ATM Packet, Intergrated service, emulation, Virtual Lan. ATM Network Management-ATM Network reference model, Integrated Management Interface: ATM Management Information base, Role of SNMD and ILMIin, Management, M1, M2, M3, M4 Interface, ATM Digital Exchange Interface Management.

MODULE V NETWORK MANAGEMENT APPLICATIONS 9

Configuration management, Fault management, Peformance management, Event Corelation Techniques security Management, Accounting management, Report Management, Policy Based Management Service Level Management.

Total Hours : 45

REFERENCES:

1. Mani Subramanian, “Network Management Principles and practice”, Addison, Wesly New York, 2000.
2. Salah Aiidarous, Thomas Plevayk, “Telecommunications Network Management Technologies and Implementations”, eastern Economy Edition IEEE press, New Delhi, 1998.
3. Lakshmi G. Raman, “Fundamentals of Telecommunication Network Management”, Eastern Economy Edition IEEE Press, New Delhi, 1999.

OUTCOMES:

On completion of the course the student will gain knowledge

- On organizational model and learn the concepts of network management
- On internet and broadband network management techniques.

ECBY14 INTERNETWORKING MULTIMEDIA

L	T	P	C
3	0	0	3

OBJECTIVES:

- The evolution of Internet service models.
- The multimedia broadband networks.
- The different coding and compression techniques.
- The multimedia standards.

MODULE I MULTIMEDIA NETWORKING 9

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics, evolution of Internet services model, network requirements for audio/ video transform, multimedia coding and compression for text, image, audio and video.

MODULE II BROADBAND NETWORK TECHNOLOGY 9

Broadband services, ATM and IP, IPV6, High speed switching, resource reservation, Buffe management, traffic shaping, caching, scheduling, and policing, throughput, delay and jitter performance. Storage and media services, voice and video over IP, MPEG-2 over ATM/IP, indexing synchronization of requests, recording and remote control.

MODULE III RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS 9

Multicast over shared media network, multicast routing and addressing, scaling multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP. MIME, Peer- to-Peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.

MODULE IV MULTIMEDIA COMMUNICATION STANDARDS 9

Objective of MPEG- 7 standard, Functionalities and systems of MPEG-7, MPEG-21 MultimediaFramework Architecture - Content representation, Content Management and usage, Intellectualproperty management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG - 4 video Transport across internet.

MODULE V MULTIMEDIA COMMUNICATION ACROSS NETWORKS 9

Packet Audio/video in the network environment, video transport across Generic network Layered video coding, error Resilient video coding techniques, Scalable Rate Control, Streaming video across Internet, Multimedia transport across ATM networks and IP network, Multimedia across wireless networks.

Total Hours : 45

REFERENCES:

1. Jon Crowcroft, Mark Handley, Ian Wakeman, “Internetworking Multimedia”, Harcourt Asia Pvt. Ltd. Singapore, 1998.
2. B.O. Szuprowicz, “Multimedia Networking”, McGraw Hill, Newyork. 1995.
3. Tay Vaughan, “Multimedia - Making it to work”, 4th edition, Tata McGraw Hill, NewDelhi, 2000.
4. K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, “Multimedia Communication systems”, PHI 2003.

OUTCOMES:

On completion of this course the student will understand

- The evolution of Internet service models.
- Multimedia broadband networks.
- Different coding and compression techniques.

ECBY15 INTERNET DENIAL OF SERVICE

L	T	P	C
3	0	0	3

OBJECTIVE:

- To study about the Denial of service attacks in crippling applications, servers and old networks and its prevention.

MODULE I INTRODUCTION AND HISTORY OF DoS AND DDoS 9

Difference between DoS and DDoS, Understanding DoS: Ulterior motive, Attackers,Distribution effects, DDoS: Hype or reality, Vulnerability to DoS, History: Motivation, Design principles of the internet,DoS and DDoS Evolution.

MODULE II ATTACK WAGING AND DDoS DEFENSES 9

Recruitment of the agent network, Controlling the DDoS agent network, Semantic levels of DDoS attacks-Attack toolkits, IP spoofing, DDoS attack trends, DDoS defense challenges, prevention Vs. Protection and reaction, DDoS defense goals and locations, Defense approaches.

MODULE III DEFENSE APPROACHES 9

Thinking about defense, general strategy for DDoS defense, preparing to handle a DDoS attack, Handling ongoing DDoS attack as a target and source, Agreement with local ISP, Analysing DDoS tools.

MODULE IV SURVEY OF DEFENSE RESEARCH APPROACHES 9

Pushback- Trace back-D-Ward-Net bouncer-Security overlay services (SOS), Proof of work, Def COM-COSSACK-PI-SIFF: An end-host capability mechanism to mitigate DDoS flooding attacks, Hop-count filtering, Locality and entropy principles.

MODULE V LEGAL ISSUES 9

Basics of the US legal system, Laws that may apply to DDoS attacks, Victims of DDoS, Legal assistance in DDoS, case initiating legal proceedings as a victim of DoS, Estimating damages, Jurisdictional issues, Domestic legal issues, International legal issues, Current trends in international cyber law.

Total Hours : 45

REFERENCES:

1. Jelena Mirkovic, Sven Dietrich, David Dittrich, Peter Reiher, “Internet Denial of Service: Attack and Defense Mechanisms”, Published by Prentice Hall PTR, 2004.

2. James Kempf, “Wireless Internet Security: Architecture and Protocols”, Published in the United States of America by Cambridge University Press, New York 2008.

3. Kaufman, C., Perlman, R., & Speciner, M (2002), “Network Security: PRIVATE Communications”, PUBLIC World. Upper Saddle River, NJ: Prentice Hall.

4. Ed Skoudis; Tom Liston, “Counter Hack reloaded”, Second Edition: A Step-by - Step Guide to Computer Attacks and Effective Defences, Prentic Hall, PTR, 2005.

OUTCOMES:

On completion of this course the student will understand

- new threat in DoS and DDoS attacks
- to prepare for these attacks, preventing them when possible, dealing with them when they occur.

ECBY16 QoS IN ADHOC WIRELESS NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge in Medium access protocol, Ad-hoc networks, and design of routing protocols for QoS support.

MODULE I INTRODUCTION **9**

Introduction to Adhoc networks, definition, characteristics features, applications. Characteristics of wireless channel, Adhoc Mobility Models: Indoor and Outdoor models.

MODULE II MEDIUM ACCESS PROTOCOLS **9**

MAC Protocols: design issues, goals and classification. Contention based Protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards:-802.11a, 802.11g, 802.15. HIPERLAN.

MODULE III NETWORK PROTOCOLS **9**

Routing Protocols: Design issues, goals and classification. Proactive vs. reactive routing, Unicast routing algorithms, Multicast routing algorithms, energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

MODULE IV PROTOCOLS FOR QOS SUPPORT **9**

RSVP Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms, Multiprotocol Label Switching, Operations, Label Stacking, Protocol details, RTP: Protocol Architecture, Data transfer Protocol, RTCP.

MODULE V QOS IN AD-HOC NETWORKS **9**

Issues and challenges, Classification of QoS solution : MAC layer solutions, Network layer solutions, QoS frameworks for Ad-Hoc Wireless networks, Energy management in Ad-hoc wireless networks, Need for energy management in Ad-hoc wireless networks.

Total Hours : 45

REFERENCES:

1. C. Siva Ram Murthy and B.S.Manoj "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall PTR,2004

2. C.K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR ,2001

3. William Stallings, "High Speed Networks and Internet", Pearson Education, Second Edition, 2002. [Chapter- 4-6,8, 10, 12, 13, 17,18]

OUTCOMES:

On completion of the course the students would be able to understand

- the fundamental concepts, design issues , solution for the issues , architecture
- protocols of ad hoc wireless networks,
- QoS and energy management in Adhoc wireless networks.

ECBY17 WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the students to Wireless Sensor Network Architecture and its Applications
- To enable the students understand the physical layer design, MAC protocols, routing protocols used for sensor network.
- To impart knowledge in basics of sensor network programming.

MODULE I NODE ARCHITECTURE **7**

Introduction to sensor network – Application – Difference between Adhoc and Sensor Network - Node architecture - Hardware components overview - Energy consumption of Sensor nodes -Operating Systems and Execution Environment - some examples of Sensor nodes.

MODULE II NETWORK ARCHITECTURE **7**

Sensor Network Scenarios – Optimization goals- Design Principles –Gateway Concepts–Wireless Channel fundamentals - Physical layer and transceiver design considerations in Wireless Sensor Network.

MODULE III MAC PROTOCOLS **8**

Fundamentals of MAC Protocols – Low duty cycle protocols – Contention based Protocols – schedule based protocols – IEEE 802.15.4 MAC – Address and name management in wireless sensor network.

MODULE IV LOCALIZATION AND POSITIONING **5**

Need for time synchronization in sensor network – properties of localization and positioning procedures – Range based Localization – Range free Localization.

MODULE V ROUTING PROTOCOLS **9**

Routing Metrics – Data Centric Routing – Proactive Routing - On Demand Routing – Hierarchical Routing – QoS based Routing Protocols.

MODULE VI SENSOR NETWORK PROGRAMMING 9

Challenges in sensor network programming – Node Centric programming – Macro programming – Dynamic programming – Sensor Network Simulators

Total Hours : 45

REFERENCES:

1. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley and Sons, 2012.
2. Waltenegus Dargie and Christian Poellabauer, “Fundamentals of Wireless Sensor Networks – Theory and Practice”, John Wiley and Sons, First edition, 2010.
3. G.Anastasi, Marco Conti, Mario Di Francesco and Andrea Passarella, “Energy Conservation in Wireless Sensor Networks: A Survey”, Adhoc Networks, Vol.7, No.3 May 2009, Elsevier Publications, pp.537-568.

OUTCOME:

- At the end of the course students will have knowledge about the sensor network architecture, protocols and will be able to use this to design a sensor network for a real time application.

ECBY18 **RF SYSTEM DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

- To know the importance and issues involved in RF design.
- To familiarize with the RF components and design techniques of filters, amplifiers and oscillators.

MODULE I RF ISSUES **9**

Importance of RF design, Electromagnetic Spectrum, RF behaviour of passive components, Chipcomponents and Circuit Board considerations, Scattering Parameters, Smith Chart and applications.

MODULE II RF FILTER DESIGN **9**

Overview, Basic resonator and filter configuration, Special filter realizations, Filter implementations, Coupled filter.

MODULE III ACTIVE RF COMPONENTS & APPLICATIONS **9**

RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks –Impedance matching using discrete components, Microstripline matching networks, Amplifier classes of operation and biasing networks.

MODULE IV RF AMPLIFIER DESIGNS **9**

Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, Broadband , high power and multistage amplifiers.

MODULE V OSCILLATORS, MIXERS & APPLICATIONS **9**

Basic Oscillator model, High frequency oscillator configuration, Basic characteristics of Mixers; Phase Locked Loops; RF directional couplers and hybrid couplers; Detector and demodulatorcircuits.

Total Hours : 45

REFERENCES:

1. Reinhold Ludwig and Powel Bretchko, “RF Circuit Design - Theory and Applications”, Pearson Education Asia, First Edition, 2001.
2. Joseph . J. Carr, “Secrets of RF Circuit Design” , McGraw Hill Publishers, 3rd Edition, 2000.
3. Mathew M. Radmanesh, “Radio Frequency & Microwave Electronics”, Pearson Education Asia, Second Edition, 2002.
4. Ulrich L. Rohde and David P. NewKirk, “RF/ Microwave Circuit Design”, John Wiley & Sons, USA 2000.
5. Roland E. Best, “Phase - Locked Loops: Design, Simulation and Applications”, McGraw Hill Publishers, 5th edition 2003.

OUTCOMES:

On completion of this course the student will be knowledgeable in

- The importance of RF design and the specific issues involved.
- Realization and design of RF circuits.
- Characteristics of RF circuits and applications.

ECBY19 MIMO SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

To learn and acquire knowledge in

- MIMO communications in wireless channels
- Spatial multiplexing and diversity techniques
- MIMO channel modeling
- MIMO channel capacity and information rates
- MIMO system antenna selection

MODULE I INTRODUCTION TO MIMO SYSTEMS AND WIRELESS CHANNELS 9

Need for MIMO systems, MIMO communications in wireless standards, Wireless channels, Outage probability over fading channels, Diversity techniques, Multiple antennas in wireless communications.

MODULE II SPATIAL MULTIPLEXING AND CHANNEL MODELING 9

Multiplexing capability : Capacity via singular value decomposition – Physical modeling of MIMO channels: LOS - SIMO and MISO model, MIMO multipath channel model, degrees of freedom and diversity.

MODULE III CAPACITY AND INFORMATION RATES OF MIMO CHANNELS 9

Capacity and information rates of AWGN and fading channels, capacity of MIMO Channels, MIMO frequency selective channels - Capacity and Information rates.

MODULE IV SPACE TIME CODING FOR FREQUENCY SELECTIVE FADING CHANNELS AND MIMO OFDM 9

Interpretation of MIMO FS channel, simple full diversity code, space time Trellis code, concatenated code, MIMO – OFDM channel model, Space-Frequency coding.

MODULE V ANTENNA SELECTION FOR MIMO SYSTEMS 9

Capacity based antenna selection, energy based antenna selection, antenna selection for space time block code, antenna selection with non idealities.

Total Hours : 45

TEXT BOOK:

1. Tolga M. Duman and Ali Ghrayeb, 'Coding for MIMO communication systems', John Wiley & sons, 2007

REFERENCES :

1. Andrea Goldsmith, 'Wireless communications', Cambrige university Press, 2005
2. Davi Se, Pramod Viswanath, 'Fundamentals of wireless communications', Cambridge University press,2005
3. Theodore S.Rappaport, 'Wireless communications : Principles and practice, Pearson Education,2002

OUTCOMES:

At the end of the course, the student will have knowledge on

- MMO wireless communications, the need and advantages
- MIMO channels and characteristics
- Channel coding, capacity and information rates
- Antenna selection for MIMO systems

ECBY20 COGNITIVE AND CO-OPERATIVE RADIO COMMUNICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire knowledge on cooperative communications
- To learn cooperation protocols and networking
- To acquire knowledge on broadband cooperative communications
- To understand cognitive radio networks

MODULE I COOPERATIVE COMMUNICATIONS **9**

Cooperation protocols- Hierarchical cooperation; Cooperative communications with single Relay – System model, DF Protocol, AF protocol; Multi-node cooperative communications – system model and protocol description; Distributed space–time coding (DSTC) – Distributed space–frequency coding (DSFC); Relay selection- protocol, criterion.

MODULE II DIFFERENTIAL MODULATION AND COOPERATIVE NETWORKING **9**

Differential modulations for DF cooperative communications - Differential modulation for AF cooperative communications; Cognitive multiple access via cooperation – System model, CCMA protocol; Content-aware cooperative multiple access – system model, protocol ; Distributed cooperative routing – network model and transmission models , cooperation based routing algorithm; Source–channel coding with cooperation- joint source channel coding bit rate allocation, joint source channel coding with user cooperation, source channel cooperation tradeoff problem.

MODULE III BROADBAND COOPERATIVE COMMUNICATIONS **9**

System model - Cooperative protocol and relay assignment scheme - Network lifetime maximization - system model, via cooperation - System model - Lifetime maximization by employing a cooperative node - Deploying relays to improve device lifetime.

MODULE IV COGNITIVE RADIOS AND NETWORKS **9**

Cognitive Radios and Dynamic Spectrum Access - Fundamental Limits of Cognitive Radios -Mathematical Models Toward Networking Cognitive Radios; Network Coding for Cognitive Radio Relay Networks - Cognitive Radio Networks Architecture; Overview of Spectrum Sensing concept.

Total Hours : 45

REFERENCES:

1. K.J. Rayliu, A.K. Sadek, Weifeng Su & Andres Kwasinski, “Cooperative Communications and Networking”, Cambridge University Press, 2009.

2. Kwang-Cheng Chen and Ramjee Prasad, “Cognitive Radio Networks”, John Wiley & Sons, 2009.

OUTCOME:

- At the end of the course, the student will have knowledge on cooperative communications and cognitive radios, the system models, protocols and network architecture.

ECBY21 RF WIRELESS SYSTEMS AND STANDARDS L T P C
3 0 0 3

OBJECTIVES:

To learn and acquire knowledge on

- Wireless and RF standards
- 2G,3G and 4G technologies and its spectrum
- WLAN, WIMAX and UWB standards

MODULE I INTRODUCTION TO CELLULAR STANDARDS 9

2G GSM, Cell structure, Frequency Bands and Channels- Call processing, Identity numbers, Frame structure, Interfaces, GMSK modulation, Voice and data processing, GPRS, EDGE, EDGE+, CDMA signal processing, IS-2000 system, Frequency bands, Channel allocation, CDMA cell capacity, services provided by IS-2000, 1xEVDO signal processing and data services-3G UMTS signal processing, WCDMA, HSPA, HSPA+, Towards 4th G, LTE and LTE advanced.

MODULE II WIRELESS SYSTEMS 9

Advanced Mobile Phone Systems (AMPS) – Characteristics – Operation – General Working of AMPS Phone System – Global System for Mobile Communication – Frequency Bands and Channels – Frames – Identity Numbers – Layers, Planes and Interfaces of GSM – International Mobile Telecommunications (IMT-2000) – Spectrum Allocation – Services provided by 3G Cellular Systems – Harmonized 3G Systems – Universal Mobile Telecommunications Systems (UMTS).

MODULE III THE IEEE 802.11 WLAN STANDARD 9

Introduction to IEEE 802.11 – General Description – Medium Access Control (MAC) – Physical Layer for IEEE 802.11 Wireless LANs; Radio systems – IR Systems Applications.

MODULE IV THE IEEE 802.16 WIMAX STANDARD 9

Introduction to IEEE 802.16 – General Description – Medium Access Control (MAC) –Radio systems – Physical Layer- Evolution to 802.16m-Bluetooth, Zigbee, RFID

MODULE V RECENT ADVANCES **9**

Introduction – Ultra Wide Band (UWB) Technology – Characteristics – Signal Propagation – Current Status and Applications – Advantages – Disadvantages – Challenges and Future Directions.

Total Hours : 45

REFERENCES:

1. Assuncion Santamaria, Francisco Lopez-Hernandez, “Wireless LAN Standards and Applications”, Artech House, 2001.
2. Dharma Prakash Agarwal and Qing- An zeng, “Introduction to Wireless and Mobile Systems”, Vikas publishing House, New Delhi, 2004.
3. Neeli Prasad and Anand Prasad, “WLAN System & Wireless IP for Next Generation Communications”, Artec House, 2002.
4. Moray Rumney : LTE and the Evolution to 4G Wireless”,Wiley,2009

OUTCOME:

- On completion of this course, the students will have the knowledge on the latest technologies and standards like 3G, 4G and UWB.

ECBY22 SOFTWARE RADIO ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES:

To understand

- The concepts of software radio
- Design issues in software radio
- Signal generation and processing and RF design
- Cognitive radio and its spectrum issues

MODULE I INTRODUCTION **7**

The Need for Software Radios. Characteristics and Benefits of a Software Radio – Design Principles of a Software Radio.

MODULE II RADIO FREQUENCY IMPLEMENTATION ISSUES **9**

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 - Noise and Distortion in the RF Chain. ADC and DAC Distortion.

MODULE III DIGITAL GENERATION OF SIGNALS **9**

Introduction-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-ROM Compression Techniques.

MODULE IV RADIO FREQUENCY DESIGN **12**

Baseband Signal Processing, Radios with intelligence, ADC and DAC architectures- Smart antennas, Adaptive techniques, Phased array antennas, Applying SDR principles to antenna systems, Smart antenna architectures.

MODULE V COGNITIVE RADIO **8**

Introduction-communication policy and spectrum-spectrum sensing-spectrum

management –spectrum mobility-spectrum sharing-SDR as Platform for Cognitive radio.

Total Hours : 45

REFERENCES:

1. Jeffrey H Reed, “Software Radio: A Modern Approach to Radio Engineering”, PEA Publication, 2002.
2. Walter Tuttle bee, “Software Defined Radio: Enabling Technologies”, Wiley Publications, 2002.
3. Paul Burns, “Software Defined Radio for 3G”, Bartech House, 2002.
4. Markus Dillinger, “Software Defined Radio: Architectures, Systems and Functions”, 2003.
5. Bard,Kovarik,”Software Defined Radio, The Software Communications Architecture”, Wiley 2007.
6. Peter Kenington, “RF And Baseband Techniques for Software Defined Radio. Artech House Publishers”, 2005,
7. Bruce Alan Fette,”Cognitive radio technology”, Academic Press, 2009.

OUTCOMES:

On completion of this course, the students can able to:

- understand the software radio architecture
- cognitive radio and its spectrum issues
- RF design issues.

ECBY23 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn soft computing algorithms.
- To introduce new ideas of neural networks, fuzzy logic and use of heuristics based on human experience.
- To understand the concepts of Genetic algorithm and its applications.

MODULE I NEURAL NETWORK **7**

Machine Learning Basics, Fundamental concept, Evolution of Neural Networks, Basic Models of Artificial Neural Networks, Important Terminologies of ANNs, McCulloch, Pitts Neuron, Supervised Learning Network:, Multiple Adaptive Linear Neurons – Back, Propagation Network, Radial Basis Function Network.

MODULE II ARTIFICIAL NEURAL NETWORK **7**

Associative Memory Networks: Training Algorithms for Pattern Association – Autoassociative Memory Network, Heteroassociative Memory Network – Bidirectional Associative Memory, Hopfield Networks, Iterative Autoassociative Memory Networks, Temporal Associative Memory Network. Unsupervised Learning Networks: Fixed weight Competitive Nets, Kohonen Self,Organizing Feature Maps, Learning Vector Quantization, Counter propagation Networks, Adaptive Resonance Theory Networks, Special Networks.

MODULE III FUZZY SET THEORY **7**

Introduction to Classical Sets and Fuzzy sets, Classical Relations and Fuzzy Relations, Tolerance and Equivalence Relations, Membership Functions: Fuzzification, Methods of Membership Value Assignments, Defuzzification, Lambda, Cuts for Fuzzy sets and Fuzzy Relations, Defuzzification Methods.

MODULE IV FUZZY SET THEORY **7**

Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning: Truth values and Tables in Fuzzy logic, Fuzzy Propositions, Formation of Rules, Decomposition and Aggregation of rules, Fuzzy Reasoning, Fuzzy Inference Systems (FIS), Fuzzy Decision Making, Fuzzy Logic Control Systems.

MODULE V GENETIC ALGORITHM 8

Introduction, Basic Operators and Terminologies in GAs, Traditional Algorithm vs. Genetic Algorithm, Simple GA, General Genetic Algorithm, The Scheme Theorem, Classification of Genetic Algorithm, Holland Classifier Systems , Genetic Programming.

MODULE VI APPLICATIONS OF SOFT COMPUTING 9

A Fusion Approach of Multispectral Images with SAR Image for Flood Area Analysis, Optimization of Travelling Salesman Problem using Genetic Algorithm Approach, Genetic Algorithm based Internet Search Technique, Soft Computing based Hybrid Fuzzy Controllers, Soft Computing based Rocket Engine, Control.

Total Hours : 45

REFERENCES:

1. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
2. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004.
3. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications and Programming Techniques”, Pearson Edition., 2003.

OUTCOMES:

- To obtain the theoretical and practical knowledge for design and development of basic intelligent systems.
- Develop an application using various soft computing algorithms.
- Solving various real world problems using soft computing algorithms.

ECBY24 QUANTUM COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an introduction to the theory and practice of quantum computation.
- To develop the knowledge of quantum computation and quantum information from the basics.
- To understand about various quantum algorithms and quantum error correction.

MODULE I INTRODUCTION TO QUANTUM MECHANICS 10

Introduction to quantum computing- Power of quantum computing- Quantum information-Quantum Computers. The Superposition probability rule- A Photon coincidence experiment- Quantum mechanics-Hilbert space- linear operators tensor and outer products- Quantum states- Quantum operators- spectral decomposition of a quantum operators.

MODULE II QUBITS AND QUANTUM GATES 10

Qubits, blocks sphere representation- Rotation operation-the measurement of a single qubits- A pair of qubits-Qubits-physical implementation-Measurement of the spin- Qubit as polarized photon- Entanglement, Exchange of information-single qubit gates- two, three and multiple qubit gates- The Toffoli gates- Matrix representation of quantum gates and circuits.

MODULE III QUANTUM CIRCUITS 9

The No-Cloning theorem- Full adder circuits- Single and multiple qubit controlled operations-Universal quantum gate-State transformation-Quantum circuit for the Walsh-Hadamard transform- Mathematical models of quantum computer.

MODULE IV QUANTUM ALGORITHM 10

Introduction to quantum algorithms.Deutsch-Jozsa algorithm, Grover's quantum search algorithm, Simon's algorithm. Shor's quantum factorization algorithm.

MODULE V ERROR CORRECTION 6

Errors and correction for errors. Simple examples of error correcting codes in

classical computation.Linear codes. Quantum error correction and simple examples. Shor code.

Total Hours: 45

REFERENCES:

1. "Approaching Quantum Computing", Dan C.Marinescu, Gabriela M.Marinescu, Pearson Education, 2008-09.
2. "Quantum Computing", Vishal Sahni Lov K Grover, Tata McGraw-Hill Publishing Company Limited,2007. ISBN: 9780070657007
3. "Quantum Computation and Quantum Information", Nielsen, Michael A and Isaac L. Chuang. Cambridge, UK: Cambridge University Press, September 2000. ISBN: 9780521635035.
4. "Quantum Computing: A Gentle Introduction" Eleanor G. Rieffel and Wolfgang H. Polak, The MIT Press Cambridge, Massachusetts London, England, 2011.

OUTCOMES:

- The students will be able to get knowledge on quantum information theory.
- The students will be able to understand the quantum mechanics instead of classical mechanics to model information and its processing.

ECBY25 ERROR CONTROL CODING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the students to traditional and modern coding theory techniques.
- To make them understand the importance of Coding techniques in Digital Communication
- To impart knowledge in recent advancements in turbo codes and applications of Error Control codes

MODULE I CODING AND ALGEBRA 9

Linear Block Codes: Generator and parity-check matrices, Minimum Distance, Sydrome decoding, Bounds on minimum distance. Cyclic Codes: Algebra-Finite fields- Groups, Fermat's Little theorem, Finite fields, Polynomials over fields, Polynomial Division. Polynomial factorization over a field, Irreducible polynomials, Existence and construction of fields of a given size. Examples of finite field construction, Binary BCH codes, RS codes.

MODULE II CODING IN AWGN CHANNELS 9

AWGN channel: Coding gain, Encoding and decoding in AWGN channels. BPSK modulation, Capacity, Coding gain, ML and MAP decoding for Repetition codes, Probability of decoding error, Channel Capacity, Capacity for various schemes, Eb/No, Coding Gain. Soft-versus hard-decision decoding .Convolutional Codes: Encoders, Trellis, Viterbi decoding, Recursive convolutional encoders.

MODULE III MODERN ITERATIVE CODING 9

Turbo codes: Encoders, interleavers, Puncturing. turbo decoder.Low-density Parity-check Codes (LDPC): Ensembles of LDPC codes, Gallager decoding algorithm for LDPC codes, LDPC Threshold. Message-passing decoders, and density evolution for AWGN channels.

MODULE IV RECENT DEVELOPMENTS IN TURBO CODES 9

Various interleavers, Nonsystematic Turbo codes, Turbo codes in 3G, Effect of Fast Correlation, Low complexity turbo decoder design, turbo codes and ARQ scheme, 3D Turbo codes

MODULE V ERROR CONTROL CODING – APPLICATIONS 9

Wireless Sensor Networks(WSN), low power WSN using ECC, Energy efficient WSN using ECC , Embedded WSN, ZIGBEE, WSN key Management. Embedded Systems, Impact on Embedded system design

TOTAL:45 Hrs

REFERENCES:

1. Shu Lin and Daniel Costello, “Error Control Coding”, Pearson, II edition, 2004.
2. Rudiger Urbanke and Thomas Richardson “Modern coding theory”, Cambridge 2008.
3. F. J. MacWilliams and N. J. A. Sloane, “The theory of error-correcting codes”, North-Holland publishers, 1983.
4. Richard Blahut “Algebraic codes for data transmission” Cambridge, 2003.
5. Thierry Lestable, Moshe Ran, “Error Control Coding for B3G/4G Wireless Systems”, John Wiley & Sons ltd, 2011.
6. Dhouha Kbaier Ben Ismail, Catherine Douillard and Sylvie Kerouédan, “A survey of three-dimensional turbo codes and recent performance enhancements” Journal on Wireless Communications and Networking 2013, Vol. 2013:115.
7. Kbaier Ben Ismail, C. Douillard and S. Kerouédan “Analysis of 3-Dimensional Turbo Codes”, annals of telecommunications 2011,Vol. 67, Issue 5-6 ,pp 257-268.

OUTCOME:

On completion of the course the student will

- have the knowledge of modern coding techniques.
- be able to compare and analyze the performance of all type of codes
- be able to develop an efficient coding technique for a given application.

SSB7181 SOCIETY, TECHNOLOGY AND SUSTAINABILITY L T P C
3 0 0 3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 9

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life –Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 9

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change

MODULE III SOCIETY AND TECHNOLOGY 9

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE **9**

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY **9**

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours : 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, ‘Sustainability Science and Engineering: Defining Principles’, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

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

- understand the benefits of modern technology for the well-being of human life.
- connect sustainability concepts and technology to the real world challenges.
- find pathway for sustainable society.