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 (2009), CURRICULUM AND SYLLABUS
FOR
M.Tech. COMMUNICATION SYSTEMS
(FOUR SEMESTERS - FULL TIME)

(Updated upto June 2012)

REGULATIONS -2009 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 the University.

vi) **'Dean (Academic Courses)'** means Dean (Academic Courses) of B.S.Abdur Rahman University.

vii) **'Dean (Students)'** means Dean(Students) 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

Candidates 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 Head of the Institution through the Head of the Department, if the student satisfies the clause 2.3.5 of this Regulations. 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 candidates 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 candidates are required to attend only evening classes.

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

2.3. ADMISSION REQUIREMENTS

2.3.1 Candidates for admission to the first semester of the Master's Degree Programme shall be required to have passed an appropriate degree examination of this University as specified in Table 1 or any other examination of any University or authority accepted by the University as equivalent thereto.

2.3.2 Notwithstanding the qualifying examination the candidate might have passed, he/she shall have a minimum level of proficiency in the appropriate programme/courses as prescribed by the institution from time to time.

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

2.3.4 All part-time candidates should satisfy other conditions regarding experience, sponsorship etc., which may be prescribed by the institution from time to time.

2.3.5 A candidate eligible for admission to M.Tech. Part Time - Day Time programmeshall have his/her permanent place of work within a distance of 65km from the campus of the institution.

2.3.6 A candidate eligible for admission to M.B.A. Part Time - Evening programme shall have a working experience of 2 years at least at supervisory level. He/ she shall have his/her place of work within a distance of 65 km from the campus of the institution.

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.Sc. (Full Time)	4	8

3.2 The P.G. programmes will 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. Practical training

3.3 The curriculum and syllabi of all the P.G. programmes shall be approved by the Academic Council.

3.4 The 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 75 to 80 working days spread over sixteen weeks. End-semester examinations will follow immediately after these working days.

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)	B.E. / B.Tech. (Civil Engineering) /(Structural Engineering)
02.	Mechanical Engineering	M.Tech. (CAD - CAM)	B.E. / B.Tech. (Mechanical / Auto /Manufacturing / Production / Industrial/Mechatronics / Metallurgy / Aerospace/Aeronautical / Material Science / Marine Engineering)
		M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Auto / Manufacturing / Production / Industrial/Mechatronics / Metallurgy / Aerospace/Aeronautical / Material Science / Marine Engineering)
03.	Polymer Technology	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)	B.E/B.Tech (EEE/ECE/E&I/ I&C/ Electronics/ Instrumentation)
05.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	M.Tech (Power System Engg) 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
06.	ECE Department jointly with Physics Department	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
09	Information Technology	M.Tech. (Information Technology)	B.E /B.Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics) MCA
10	Computer Applications	M.C.A.	Any degree. Must have studied Mathematics / Statistics /Computer oriented subject.
		M.Tech. (Systems Engineering and Operations Research)	Any degree. Must have studied Mathematics / Statistics /Computer oriented subject.
11	Mathematics	M.Sc. (Actuarial Science)	B.Sc. (Mathematics) of B.Sc. (Applied Science)
12	Chemistry	M.Sc.(Chemistry)	B.Sc (Chemistry) of B.Sc. (Applied Science)

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

Programme	Minimum prescribed credit range
M.Tech.	70 to 80
M.C.A	130 to 140
M.Sc	74 to 80

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 of two or three periods per week
* One credit for four weeks of practical training

3.8 The number of credits registered by a candidate 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 23	12 to 20
M.Tech. (Part Time)	6 to 12	12 to 16
M.C.A. (Full Time)	12 to 25	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 candidate may be permitted by the Head of the Department to choose electives offered from other P.G. Programmes either within a 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 candidate 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 Dean (AC) 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 Practical training or industrial attachment, if specified in the curriculum shall be of not less than four 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 candidate may however, in certain cases, be permitted to work on the project in an Industrial/Research Organization, on the recommendation of Head of the Department, with the approval of the Head of the Institution. In such cases, the project work shall be jointly supervised by a supervisor of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the supervisor 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 Head of the Institution.

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 candidate 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 the Masters Degree will not be permitted to enroll for more courses to improve his/her cumulative grade point average (CGPA).

4.0 FACULTY ADVISER

To help the students in planning their courses of study and for getting general advice on academic programme, the concerned department will assign a certain number of students to a faculty member who will be called the Faculty Adviser.

5.0 CLASS COMMITTEE

5.1 Every class of the P.G. 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. One or two students of the class, nominated by the Head of the Department.

iv. Faculty Advisers of the class - Ex-Officio Members

v. Professor in-charge of the P.G. 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 the 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 the Head of the Institution. The class committee, **without the student members,** will also be responsible for finalization of the semester results.

5.4 The Class Committee is required to meet at least thrice in a semester, once at the beginning of the semester, another time after the end-semester examination to finalise the grades, and once in between.

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 / Head of the Institution 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 the courses he/she intends to undergo on a specified day notified to the student. The concerned Faculty Adviser will be present and guide the students in the registration/enrolment process.

7.2 For the subsequent semesters registration for the courses will be done by the student during a specified week before the end-semester 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 is filled in and signed by the student and the Faculty Adviser.

7.3 Late registration will be permitted with a prescribed fine up to two weeks from the last date specified for registration.

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

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 (AC), on the recommendation of the HOD, is permitted.

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

7.7 SUMMER TERM COURSES

7.7.1 Summer term courses may be offered by a department on the recommendation by the Departmental Consultative Committee and approved by the Head of the Institution. No student should register for more than three courses during a summer term.

7.7.2 Summer term courses will be announced by the Head of the Institution at the end of the even semester before the commencement of the end semester examinations. A student will have to register within the time stipulated in the announcement. A student has to pay the fees as stipulated in the announcement.

7.7.3 Fast-track summer courses of 30 periods for 3 credit courses and 40 periods for 4 credit courses will be offered for students with I grades. They may also opt to redo such courses during regular semesters with slotted time-tables. Students with U grades will have the option either to write semester end arrears exam or to redo the courses during summer / regular semesters with slotted time-table, if they wish to improve their continuous assessment marks also.

The assessment procedure in a summer term course will also be similar to the procedure for a regular semester course.

7.7.4 Withdrawal from a summer term course is not permitted. No substitute examination will be held for the summer term courses.

8.0 TEMPORARY WITHDRAWAL FROM THE PROGRAMME

A student may be permitted by the Head of the Institution to temporarily withdraw from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. However the total duration for completion of the programme shall not exceed the prescribed number of semesters (vide clause 3.1).

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

9.1 A candidate 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 enrol for project semester
M.Tech. (Full time)	18 (III semester)
M.Tech. (Part-time)	18 (V semester)
M.C.A. (Full time)	45 (VI semester)
M.Sc. (Full-time)	28 (IV semester)

9.2 **M.Tech.:** If the candidate has not earned minimum number of credits specified, he/she has to earn the required credits (at least to the extent of minimum credit specified in clause 9.1) and then register for the project semester.

9.3 **M.C.A.:** If the candidate has not earned the required 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 work in subsequent semesters.

10.0 DISCIPLINE

10.1 Every candidate is required to observe discipline and decorous behaviour 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 candidate reported to the Head of the Institution will be referred to a Discipline and Welfare Committee for taking appropriate action.

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

11.0 ATTENDANCE

11.1 Attendance rules for all Full Time Programme and Part time - day Time Programmes are given in the following sub-clauses.

11.2 A student **shall earn 100% attendance** in the contact periods of every course, subject to a **a maximum relaxation of 25%** for genuine reasons like on medical grounds , representing the University in approved events etc., to become eligible to appear for the end-semester examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

12.0 ASSESSMENTS AND EXAMINATIONS

12.1 The following rule shall apply to the full-time and part-time P.G. 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 at the Class Committee will be announced to the students right at the beginning of the semester by the teacher and informed to Dean(AC)

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 practical training or industrial attachment, the candidate shall submit a certificate from the organization where he/she has undergone training 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 sessional assessments	-	50%
End-semester examination	-	50%

ii) Laboratory based courses

Laboratory work assessment	-	75%
End-semester examination	-	25%

iii) Project work

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

13.2 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 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 end-semester examination of a course may be permitted to write a substitute examination. However, permissions 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 (AC) 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 end-semester 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
I	-
W	-

Flexible range grading system will be adopted

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevention from End Semester examination.

"U" denotes unsuccessful performance in a course.

15.2 A student is considered to have completed a course successfully and earned the credits if he / she secure five grade points or higher. A letter grade U in any course implies unsuccessful performance in that course. A course successfully completed cannot be repeated for any reason.

16.0 METHOD OF AWARDING 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 Three copies of the results sheets for each course, containing the final grade and three copies with the absolute marks and the final grade should be submitted by the teacher to the concerned Class Committee Chairman. After finalisation of the grades at the class committee meeting the Chairman will forward two copies of each to the Controller of Examinations and the other copies to the Head of the Department in which course is offered.

17.0 DECLARATION OF RESULTS:

17.1 After finalisation 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. In case any student feels aggrieved, he/she can apply for revaluation after paying the prescribed fee for the purpose, within two weeks from the commencement of the semester immediately following the announcement of results. A committee will be constituted by the Controller of Examinations comprising the Chairperson of the concerned Class Committee (Convener), the teacher concerned and another 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 mark to the Controller of Examinations with full justification for the revision if any.

17.2 The **“U”** 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 "I" or "W" grade is awarded. If the student is awarded "I", or "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” grade in a course shall write the end-semester examination as arrear examination , at the end of the next semester, along with the regular examinations of next semester courses. **The marks earned earlier in the continuous assessment tests for the course, will be**

used for grading along with the marks earned in the end-semester arrear examination for the course.

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

$$GPA = \frac{\sum_i (Ci)(GPi)}{\sum_i Ci}$$

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 in time.

I and W grades will be excluded for GPA calculations.

U, I 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 in first appearance in all courses	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 candidate should not have obtained U or I grade in any course during his/her study and should have completed the P.G. 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 candidate 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 candidates 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 first decimal place. For the purpose of comparison of performance of candidates and ranking, CGPA will be considered up to three decimal places.

20 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) registered for and undergone all the core courses and completed the Project Work,

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

iii) successfully completed the field visit/industrial training, if any, as prescribed in the curriculum.

iv) has no dues to the Institution, Hostels and Library.

v) 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.

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M.TECH. (COMMUNICATION SYSTEMS)
(FOUR SEMESTERS - FULL TIME)
CURRICULUM

SEMESTER I

Course Code	Course Title	L	T	P	C	TC
Theory						
MA 681	Applied mathematics for Electronics Engineering	3	1	0	4	
EC 601	Advanced Radiation system	3	0	0	3	
EC 602	Modern Digital Communication Techniques	3	1	0	4	
EC 608	Advanced Digital Signal Processing	3	1	0	4	
	Elective I	3	0	0	3	
	Elective II	3	0	0	3	
Practical						
EC 604	Communication Lab - I	0	0	4	2	**23**

SEMESTER II

Course Code	Course Title	L	T	P	C	TC
Theory						
EC 605	Mobile Communication Networks	3	0	0	3	
EC 606	Satellite Communication	3	0	0	3	
EC 607	Microwave Integrated Circuits	3	0	0	3	
EC 603	Multimedia Compression Techniques	3	0	0	3	
	Elective III	3	0	0	3	
	Elective IV	3	0	0	3	
Practical						
EC 609	Communication Lab - II	0	0	4	2	20

SEMESTER III

Theory

EC 701	RF System Design	3	1	0	4	
	Elective V	3	0	0	3	
	Elective VI	3	0	0	3	

Practical

EC 702	Project - Phase I	0	0	12	6*	10

SEMESTER IV

Practical

EC 702	Project - Phase II	0	0	35	18*	24

Total Credits : 77

* Credits for project work (Phase I) of III semester will be accounted along with Project work (Phase II) of IV semester.

LIST OF ELECTIVE COURSES

Sl. No	Course Code	Course Title	L	T	P	C
1	ECY 001	Digital Image Processing	3	0	0	3
2	ECY 002	Network Routing Algorithms	3	0	0	3
3	ECY 003	Simulation of Communication Systems and Networks	3	0	0	3
4	ECY 004	Global Tracking and Positioning Systems	3	0	0	3
5	ECY 005	Electromagnetic Interference and Compatibility in System Design	3	0	0	3
6	ECY 006	High Performance Communication Networks	3	0	0	3
7	ECY 007	Digital Communication Receivers	3	0	0	3
8	ECY 008	Optical Communication Networks	3	0	0	3
9	ECY 009	Advanced Microwave systems	3	0	0	3
10	ECY 010	Speech and Audio Signal Processing	3	0	0	3
11	ECY 011	Communication Network Security	3	0	0	3
12	ECY 012	Wireless Communications	3	0	0	3
13	ECY 013	Medical Image Processing	3	0	0	3
14	CSY 002	Soft Computing	3	0	0	3
15	CSY 081	Network Management	3	0	0	3
16	CSY 082	Internetworking Multimedia	3	0	0	3
17	CSY 083	High Speed Switching Architecture	3	0	0	3
18	ECY 014	Internet Denial of Service	3	0	0	3
19	ECY 015	QoS in Ad Hoc Wireless Networks	3	0	0	3

M.TECH. (COMMUNICATION SYSTEMS)
(FOUR SEMESTERS - FULL TIME)
CURRICULUM

MA 681	**APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS**	**L T P C**
		3 1 0 4

OBJECTIVE:

The course is designed with a purpose of developing mathematical skills to understand and solve the problems of analytical subjects in the respective engineering streams.

UNIT-1 LINEAR ALGEBRAIC EQUATIONS AND EIGEN VALUE PROBLEM 9

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.

UNIT-2 WAVE EQUATION 9

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.

UNIT-3 SPECIAL FUNCTIONS 9

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.

UNIT-4 RANDOM VARIABLES 9

One dimensional Random Variables - Moments and MGF - Binomial, Poisson Geometrical, Uniform, Exponential, Normal and Weibull distributions – Two - dimensional Random Variables – Marginal and Conditional distribution – Covariance and Correlation coefficient – Functions of one-dimensional and two - dimensional Random Variables.

UNIT-5 QUEUING THEORY 9

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

L-45 , T-15

Total : 60

REFERENCES:

1. Jain M.K., Iyengar .S.R.K: & Jain.R.K, "Numerical Methods for Scientific and Engg., Computation", New Age International (P) Ltd, Publishers, 2003.
2. Sankara Rao K., "Introduction to Partial Differential Equation", Prentice Hall of India, 1997.
3. Grewal B.S, "Higher Engg. Mathematics", Khanna Publishers, 2005.
4. Kapur J.N & Saxena. H.C, "Mathematical Statistics", S. Chand & Company Limited, New Delhi, 2003.
5. Taha H.A, " Operations Research – An Introduction",Prentice Hall of India, 2001.
6. Gross.D & Harris.C.M, "Fundamentals of Queuing Theory", John Wiley & Sons, 1985.

OUTCOME:

- Students will be in a position to apply correct method to solve a given problems. The approaches they have undergone will provide them hands on experience for doing their project work.
- They understand pretty well the implications of mathematics they have studied in their core subjects like advanced digital signal processing, communication network, image processing and so on.
- The special functions give the best of solutions for the complicated homogeneous differential equations with variable constants in power series. The special functions are used in the expansion of arbitrary functions in a series analogous to expansion of arbitrary function in fourier series.

EC 601	**ADVANCED RADIATION SYSTEMS**	**L T P C**
		3 0 0 3

OBJECTIVE:

To study principles of various types of antennas and their polarization characteristics.

UNIT I CONCEPTS OF RADIATION 9

Retarded vector potentials – Heuristic approach and Maxwell's equation approach. The Lorentz gauge condition. Vector potential in Phasor form. Fields radiated by an alternating current element. Total power radiated and radiation resistance. Radiation from Half wave dipole from assumed current distribution. Power radiated in the farfield. Electric vector potential F for a magnetic current source M. Far zone fields due to magnetic source M.

UNIT II ANTENNA ARRAYS 9

N element linear arrays – uniform amplitude and spacing. Phased arrays. Directivity of Broadside and End fire arrays. Three dimensional characteristics. Binomial arrays and Dolph-Tchebycheff arrays. Circular array. Antenna Synthesis- Line source and discretization of continuous sources. Schelkunoff polynomial method. Fourier transform method.

UNIT III APERTURE ANTENNAS 9

Magnetic current – Duality. Electric and Magnetic current sheets as sources. Huyghens source. Radiation through an aperture in an absorbing screen. Fraunhoffer and Fresnel diffraction. Cornu Spiral. Complimentary screens and slot antennas. Slot and dipoles as dual antennas. Babinets principle. Fourier transform in aperture antenna theory.

UNIT IV HORN, MICROSTRIP, REFLECTOR ANTENNAS 9

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimode horns. Phase center. Microstrip antennas – feeding methods. Rectangular patch- Transmission line model.

Parabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

UNIT V ANTENNA POLARIZATION 9

Simple relationship involving spherical triangles. Linear, Elliptical and circular polarization. Development of the Poincare sphere, Representation of the state of polarization in the Poincare sphere, Random polarization – Stokes parameters.

Total:45

REFERENCES

1. Constantine A. Ballanis , "Antenna Theory " , John Wiley & Sons, second edition, 2003.
2. Jordan, E.C.and Balmain, “Electromagnetic waves and Radiating systems”. PHI 2003
3. Krauss, J.D.,Fleisch,D.A., “Electromagnetics” McGraw-Hill,1999

OUTCOME

On completion of this course the student will be able to choose appropriate antennas for specified applications.

EC 602 MODERN DIGITAL COMMUNICATION TECHNIQUES

L	T	P	C
3	1	0	4

OBJECTIVE:

- To understand the various digital communication concepts for coherent and noncoherent communication.
- To understand the effects of band limited and fading channels on communication.
- To understand the need for error correcting codes and spread spectrum techniques.

UNIT I POWER SPECTRUM AND COMMUNICATION OVER MEMORYLESS CHANNEL 9

PSD of a synchronous data pulse stream; M-ary Markov source; Convolutionaly coded modulation; Continuous phase modulation – Scalar and vector communication over memoryless channel – Detection criteria.

UNIT II COHERENT AND NON-COHERENT COMMUNICATION 9

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; M-FSK receivers – Rayleigh and Rician channels – Partially coherent receives – DPSK; M-PSK; M-DPSK,-BER Performance Analysis.

UNIT III BANDLIMITED CHANNELS AND DIGITAL MODULATIONS 9

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.

UNIT IV BLOCK CODED DIGITAL COMMUNICATION 9

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal. Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators – Linear block codes; Hammning; Golay; Cyclic; BCH; Reed – Solomon codes.

UNIT 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.

L – 45, T – 15

Total – 60

REFERENCES:

1. M.K. Simon, S.M. Hinedi and W.C. Lindsey, “Digital communication techniques; Signaling and Detection”, Prentice Hall India, New Delhi. 1995.
2. Simon Haykin, “Digital Communications”, John Wiley and Sons, 1998
3. Wayne Tomasi, “Advanced Electronic Communication Systems”, 4th Edition, Pearson Education Asia, 1998
4. B.P. Lathi “Modern Digital And Analog Communication Systems”, 3rd Edition, Oxford University Press 1998.
5. Ian Glover, Peter Grant, “Digital Communications”, Prentice Hall, 2003 Edition, ISBN–0130893994.
6. Bernard Sklar – “Modern Digital Communication Technique – Fundamental & Applications”, Prentice Hall, 2001 Edition. ISBN – 0130847881.

OUTCOME:

On completion of this course the student will be knowledgeable

- Various digital communication techniques using QPSK, QAM, QBOM, CPFM.

EC 608 ADVANCED DIGITAL SIGNAL PROCESSING

	L	T	P	C
	3	1	0	4

[Review of discrete-time signals and systems- DFT and FFT, Z-Transform, Digital Filters is recommended]

OBJECTIVE:

- To understand the discrete time signals & systems and their analysis using various transforms.
- To learn the analysis and synthesis of IIR & FIR filters.
- To learn the basics of multirate DSP

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

Discrete Random Processes- Ensemble averages, stationary processes, Autocorrelation and Auto covariance matrices. Parseval's Theorem, Wiener-Khintchine Relation- Power Spectral Density- Periodogram Spectral Factorization , Filtering random processes. Low Pass Filtering of White Noise. Parameter estimation: Bias and consistency.

UNIT II SPECTRUM ESTIMATION OF DISCRETE SIGNALS 9

Estimation of spectra from finite duration signals, Non-Parametric Methods-Correlation Method, Periodogram Estimator, Performance Analysis of Estimators -Unbiased, Consistent Estimators- Modified periodogram, Bartlett and Welch methods, Blackman –Tukey method. Parametric Methods - AR, MA, ARMA model based spectral estimation. Parameter Estimation -Yule-Walker equations, solutions using Durbin's algorithm.

UNIT III LINEAR ESTIMATION AND PREDICTION OF DISCRETE SIGNALS 9

Linear prediction- Forward and backward predictions, Solutions of the Normal equations- Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.

UNIT IV ADAPTIVE FILTERS 9

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm, Normalized LMS. Adaptive channel equalization-Adaptive echo Cancellation-Adaptive noise cancellation- Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS, sliding window RLS.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

Mathematical description of change of sampling rate - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Sampling rate conversion by a rational factor, Filter implementation for sampling rate conversion- direct form FIR structures, Polyphase filter structures, time-variant structures. Multistage implementation of multirate system. Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

L -45 T-15

Total- 60

REFERENCES:

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons,Inc.,Singapore, 2002.
2. John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.
3. John G. Proakis et.al.,'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
4. Dimitris G.Manolakis et.al.,'Statistical and adaptive signal Processing', McGraw Hill, Newyork,2000.
5. Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.(For Wavelet Transform Topic)

OUTCOME:

After successful completion of the course, the students will be able

- To analyse and synthesize digital signals and systems using various transforms.
- To apply Wavelet Transform techniques in multirate DSP.

EC 604 COMMUNICATION SYSTEM LABORATORY – I

L	T	P	C
0	0	4	2

OBJECTIVE:

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

LIST OF EXPERIMENTS:

1. Antenna Radiation Pattern measurement.
2. Simulation of Modulation and Coding in a AWGN Communication Channel using Simulation Packages.
3. Implementation of Adaptive Filters, periodogram and multistage multirate system in DSP Processor
4. Performance evaluation of Digital Data Transmission through Fiber Optic Link.
5. Study of Spread Spectrum Techniques.
6. Simulation of QMF using Simulation Packages.
7. Implementation of Video Link using Optical Fiber.
8. Implementation of Linear and Cyclic Codes.

OUTCOME:

On completion of the course, students 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.

EC 605 MOBILE COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVE

- To learn the principles and performance evaluation of mobile communication networks.
- To study the various mobile network architectures and the related issues in the operation and management.

UNIT I OPERATION OF MOBILE COMMUNICATION NETWORKS 9

Operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, Mobile networks Elementary Principles of cellular Telephony Channel Division Techniques (TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planning and Resource Allocation, Network Dimensioning ,Mobility Management Procedures.

UNIT II PROPAGATION MODELS AND AIR PROTOCOLS 9

Radio propagation models, error control techniques, handoff, power control, Soft handover, Forward link ,Reverse link , common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, CDMA 2000, etc)

UNIT III MOBILE NETWORK ARCHITECTURE 9

General Architecture definition, Mobile Terminals (MT, SIM), Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC), User and Control Plane Protocol Stack, MAP & SS7, the Key Role of Signaling Interfaces and Network Entities Relation The Physical Channel, The Logical Channels Terminal, Call and Network Management Procedures, Network Planning.

UNIT IV WIRELESS LOCAL AREA NETWORKS 9

Wireless Local Area Networks, General Characteristics of the Hyper LAN System, 802.11 Standard, Basic DCF access scheme, DCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad Hoc Networks, Wireless Sensor Networks, Routing Energy Efficiency, Localization, Clustering.

UNIT V SECURITY ISSUES IN WIRELESS NETWORKS 9

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Security in Group Communication, Trust Establishment and Management, Denial of Service

Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion.

TOTAL : 45

REFERENCES :

1. W. Stallings, "Wireless Communications and Networks", Prentice Hall, 2002.
2. V.K. Garg, "IS-95 CDMA and CDMA 2000", Prentice Hall PTR, 2000.
3. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall, 2002.
4. Leon-Garcia and I. Widjaja, "Communication Networks, Fundamental Concepts and Key Architectures", McGraw-Hill, 2000.
5. J.Schiller,"Mobile Communications", Addison Wesley, 2000.
6. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", Addison Wesley, 2001.
7. Uyless Black,"Mobile and Wireless Networks", Prentice Hall PTR, 1996.

OUTCOME:

On completion of the course, students will be knowledgeable in

- the various architectures of mobile communication networks.
- Wireless LAN systems.
- the security algorithms used in wireless networks

EC 606 SATELLITE COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVE

- To understand the basic concepts of satellite communication.
- To know about satellite launching, related control and space subsystems.
- To understand the fundamentals of space link design, multiple access techniques and different applications.

UNIT I ORBITAL MECHANICS 9

Kepler's laws of motion, 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 vehicles- Spectrum allocations for satellite systems.

UNIT I SPACECRAFT SUBSYSTEMS AND EARTH STATION 9

Spacecraft Subsystems, Attitude and Orbit Control, Telemetry and Tracking, Power Systems, Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, Example of payloads of operating and planned systems.

UNIT III SPACE LINKS 9

The Space Link, Basic Transmission Theory, System Noise Temperature, G/T Ratio, Noise Figure,Satellite Link Design - Satellite uplink -down link power Budget, Downlink Design, Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths. Interference between satellite circuits, Energy Dispersal, Propagation characteristics of fixed and mobile satellite links.

UNITIV MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECT 9

Single access vs Multiple access (MA), Classical MA techniques: FDMA, TDMA. Single channel per carrier (SCPC) access - Code division multiple access (CDMA), Demand assignment techniques, Examples of MA techniques for existing and planned systems (e.g. the satellite component of UMTS).Mobile satellite network design, ATM via satellite. TCP/IP via satellite - Call control, handover and call set up procedures. Hybrid satellite- terrestrial networks

UNIT V SERVICES AND APPLICATIONS 9

Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satellite service: GSM, GPS, INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Video conferencing and Internet connectivity

TOTAL : 45

REFERENCES

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

OUTCOME

At the end of this course a student will be knowledgeable in

- Orbital aspects involved in satellite communication.
- Power budget calculation and multiple access techniques.
- Satellite systems and services provided.

EC607 MICROWAVE INTEGRATED CIRCUITS

	L	T	P	C
	3	0	0	3

OBJECTIVE:

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

UNIT I TECHNOLOGY OF HYBRID MICs 9

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

UNIT II TECHNOLOGY OF MONOLITHIC MICs 9

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

UNIT III ANALYSIS OF MICROSTRIP LINE, SLOT LINE AND COPLANAR WAVEGUIDES 9

Transmission lines – characteristics of conventional transmission structures - characteristics of planar transmission lines – strip line – microstrip – suspended and inverted microstrip lines – slot line – coplanar lines – comparison of various MIC transmission media – coupled line –discontinuities.

UNIT IV ANALYSIS OF COUPLED MICROSTRIP 9

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 - 180^0 degree hybrid.

UNIT V LUMPED ELEMENTS AND NON-RECIPROCAL COMPONENTS 9

Lumped elements – design of lumped elements - design of inductors – design of capacitors - design of resistors – ferromagnetic substrate for non-reciprocal devices – microstrip circulators – latching circulators – isolators – phase shifters.

TOTAL: 45

REFERENCES

1. I.J.Bhal and P.Bhartia, "Microwave solid state circuit design", John Wiley & sons, 2003 (Unit I, II, III and V).
2. David M.Pozar, "Microwave Engineering", John Wiley & sons, 1998 (Unit IV).
3. Hoffman, R.K- "Handbook of Microwave Integrated Circuits"- Artech House, 1987 (Unit I and II).
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.

OUTCOME

The student will acquire the domain knowledge in

- The fabrication and operation of microwave devices.
- The different types of MICs and its transmission lines
- The concept, analysis and design of micro strip line.
- The design and analysis of non-reciprocal components and active devices.

EC 603 MULTIMEDIA COMPRESSION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT 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.

UNIT II TEXT COMPRESSION 9

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

UNIT 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.

UNIT 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.

UNIT 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: 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.
7. Watkinson,J : Compression in Video and Audio, Focal press,London.1995.
8. Jan Vozer : Video Compression for Multimedia, AP Profes, NewYork, 1995.

OUTCOME:

On completion of the 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.

EC 609 **COMMUNICATION LAB – II**

L	T	P	C
0	0	4	2

OBJECTIVE:

To get an exposure on the practical aspects of

- Audio and speech compression algorithms.
- RF and Microwave devices and their properties.
- Performance analysis of CDMA technique and its application in GPS.

List of experiments

1. Simulation of Audio and speech compression algorithms
2. Simulation of EZW / SPIHT Image coding algorithm.
3. Simulation of Microstrip Antennas
4. S-parameter estimation of Microwave devices.
5. Study of Global Positioning System.
6. Performance evaluation of simulated CDMA System.
7. Design and testing of a Microstrip coupler.
8. Characteristics of ?/4 and ?/2 transmission lines.

OUTCOME:

On completion of the course, students will be

- Able to use simulation tools like MATLAB and LABVIEW to design and validate their compression algorithms and antenna designs.
- Knowledgeable in the design aspects of microwave integrated circuits and advance RF systems.
- Competent in CDMA techniques and GPS applications.

EC701 RF SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT 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.

UNIT II RF FILTER DESIGN 9

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

UNIT 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.

UNIT 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.

UNIT 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: 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, Third 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.

OUTCOME:

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.

ELECTIVES

ECY001 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVE:

To study

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

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals -RGB,HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries.

UNIT II IMAGE TRANSFORMS 9

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, and Wavelet Transform.

UNIT III IMAGE ENHANCEMENT AND RESTORATION 9

Histogram modification and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic filters, Homomorphic filtering, Color image enhancement. Image Restoration –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.

UNIT IV IMAGE SEGMENTATION AND RECOGNITION 9

Edge detection. Image segmentation by region growing, region splitting and merging, edge linking.. Image Recognition – Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Back Propagation Neural Network, Neural Network applications in Image Processing.

UNIT V IMAGE COMPRESSION 9

Need for data compression, Huffman,. Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding. Transform Coding – DCT and Wavelet. JPEG, MPEG. Standards, Concepts of Context based Compression.

Total: 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.
6. Milman Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis, and Machine Vision', Brooks/Cole, Vikas Publishing House, II ed., 1999.
7. Sid Ahmed, M.A., 'Image Processing Theory, Algorithms and Architectures', McGrawHill, 1995.

OUTCOME

On completion of this course the student will be knowledgeable in

- Mathematical representation of images and digital image processing methods.
- Enhancing and restoring the images in time and frequency domains.
- Lossy and lossless compression of digital images.

ECY002	NETWORK ROUTING ALGORITHMS	L T P C
		3 0 0 3

OBJECTIVE:

To understand and analyze the network routing algorithms in circuit & packet switching, optical, ATM, Mobile and Mobile ad-hoc networks.

UNIT I CIRCUIT SWITCHING NETWORKS 9

Routing in Telephone Network- Hierarchical Routing , Dynamic Routing, Dynamic Non Hierarchical Routing-Dynamically Controlled Routing- Dynamic Alternative Routing- Real Time Network Routing, Classification of Dynamic Routing Schemes, Maximum Allowable Residual Capacity Routing, Dynamic Routing and its relation to other routing.

UNIT II PACKET SWITCHING NETWORKS 9

Distance vector Routing, Link State Routing, Inter domain Routing-Classless Interdomain routing (CIDR), Interior Gateway routing protocols (IGRP) - Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) - Border Gateway Protocol (BGP)

UNIT III HIGH SPEED NETWORKS 9

Routing in optical networks-The optical layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations, Routing in ATM networks-ATM address structure, ATM Routing, PNNI protocol, PNNI signaling protocol.

UNIT IV MOBILE NETWORKS 9

Routing in Cellular Mobile Radio Communication networks-Mobile Network Architecture, Mobility management in cellular systems, Connectionless Data service for cellular systems, Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet Radio Routing.

UNIT V MOBILE AD-HOC NETWORKS (MANET) 9

Internet based mobile ad-hoc networking, communication strategies, routing algorithms – Table-driven routing - Destination Sequenced Distance Vector (DSDV), Source initiated on-demand routing- Dynamic Source Routing (DSR), Ad-hoc On- demand Distance Vector (AODV), Hierarchical based routing-

Cluster head Gateway Switch Routing (CGSR) and Temporally-Ordered Routing Algorithm (TORA), Quality of Service.

TOTAL : 45

REFERENCES

1. Deepankar Medhi and Karthikeyan Ramaswami, 'Network Routing – Algorithms, Protocols and Architectures', Morgan Kaufmann publishers, 2007.
2. Rajiv Ramaswami and Kumar N.Sivarajan, "Optical Networks", Morgan Kaufmann, Publishers,1998.
3. C.Sivarama Murthy, B S Manoj "Ad-Hoc Wireless Networks, Architectures and protocols", Prentice Hall PTR, 2004.
4. Alberto Leon Garcia, Indra Widjaja,"Communication Networks – Fundamental Concepts, Key Architectures, Second Edition, Tata McGrawHill, 2007.
5. William Stallings, "High Speed Networks TCP/IP and ATM Design Principles", Prentice Hall International, New York, 1998.
6. Sumit Kasera and Pankaj sethi, "ATM Networks", Tata McGraw-Hill Publishing Company limited, New Delhi,2001.

OUTCOME:

On completion of this course the student will be knowledgeable in

- Various optimized network routing algorithms in telephone networks and packet switching networks.
- Various routing algorithms in optical and ATM networks.
- Analyzing and comparing the different routing algorithms for MANETs.

ECY003 SIMULATIONS OF COMMUNICATION SYSTEMS & NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT 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.

UNIT 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

UNIT 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.

UNIT 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.

UNIT 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 : 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 pub – 2000 edition

OUTCOME

At the end of the course student will be aware of

- different modeling methods of channel
- channel property by mathematical and estimation methods.

ECY004 GLOBAL TRACKING AND POSITIONING SYSTEMS **L T P C**
3 0 0 3

OBJECTIVE:

- 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

UNIT I HISTORY OF GPS AND GPS SYSTEM SEGMENTS 9

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems – GPS Constellation – Space Segment – Control Segment – User Segment – Single and Dual Frequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D – reporting Anti Spoofing (AS); Selective Availability (SA) – DOP Factors.

UNIT II ELEMENTS OF SATELLITE SURVEYING 9

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial Reference System – Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – Topocentric Motion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations - Perturbed Orbit – Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination – Link to Earth Rotation – Time and Earth Motion Services.

UNIT III GPS OBSERVABLES 9

C/A code; P-code; Y-code; L1, L2 Carrier frequencies – Code Pseudo Ranges – Carries Phases – Pseudo Ranges – Satellite Signal Signature – Navigation Messages and Formats – Undifferenced and Differenced Range Models – Delta Ranges – Signal Processing and Processing Techniques – Tracking Networks – Ephemerides – Data Combination: Narrow Lane; Wide Lane – OTF Ambiguity.

UNIT IV PROPAGATION MEDIA, MULTIPATH AND PHASE CENTER 9

Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements of Wave Propagation – Ionospheric Effects on GPS Observations – Code Delay – Phase Advances – Integer Bias – Clock Error –

Cycle Slip – Noise-Bias – Blunders – Tropospheric Effects on GPS Oberservables – Multipath Effect – Antenna Phase Centre Problems and Correction.

UNIT V GPS APPLICATIONS 9

Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – Atmospheric Occulation – Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borne GPS – Metrological and Climate Research using GPS.

TOTAL : 45

REFERENCES

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 4th revised edition, Springer, Wein, New york,1997
2. A.Leick, "GPS Satellites Surveying", 2nd edition, John Wiley & Sons,NewYork,1995
3. B.Parkinson, J.Spilker, Jr.(Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA, 370 L'Enfant Promenade SW, Washington, DC 20024, 1996
4. A.Kleusberg and P.Teunisen(Eds), “GPS for Geodesy”, Springer-Verlag, Berlin,1996
5. L.Adams, "The GPS - A Shared National Asset”, Chair, National Academy Press, Washington, DC, 1995
6. Akash Deepak Sharma – GPS MD Publications Jan 2008
7. Wellenhof, Gelbert and Elman – GPS- Springer 2000 edition

OUTCOME

On completion of this course the student will understand

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

ECY005	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVE:

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

UNIT I EMI ENVIRONMENT 9

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.

UNIT II EMI COUPLING PRINCIPLES 9

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.

UNIT III EMI/EMC STANDARDS AND MEASUREMENTS 9

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

UNIT IV EMI CONTROL TECHNIQUES 9

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

UNIT V EMC DESIGN OF PCBs 9

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

TOTAL: 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 edition 2nd edition.

OUTCOME:

On completion of this course the student will understand

- electromagnetic interferences and EMI coupling.
- various EMI standards and their implications
- various techniques to optimize a design of EMI

ECY006	HIGH PERFORMANCE COMMUNICATION NETWORKS	L T P C
		3 0 0 3

OBJECTIVE

- To study the computer network architectures designed for the use in the high-speed networking environment.
- To study the design issues of the internet as a high-speed network, ATM networks, and high-speed LANs and MANs
- To study the design of Bluetooth technology and its standards.

UNIT 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.

UNIT II ISDN AND BROADBAND ISDN 9

ISDN - Overview, Interfaces and functions, Layers and services - Signaling System 7 (SS7) - Broadband ISDN architecture and Protocols.

UNIT 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.

UNIT IV ADVANCED NETWORK ARCHITECTURE 9

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

UNIT V BLUE TOOTH TECHNOLOGY 9

The Blue tooth module-Protocol stack Part I: Antennas, Radio interface, Base band, The Link controller, Audio, The Link Manager, The Host controller interface; The Blue tooth module-Protocol stack Part I: Logical link control and adaptation protocol, RFCOMM, Service discovery protocol, Wireless access protocol, Telephony control protocol.

TOTAL : 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

On completion of the course, the students will be aware

- of the architectures and design of OSI and IP models
- ATM , frame relay and bluetooth technology

ECY007 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.

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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, Echo cancellation

TOTAL : 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

OUTCOME

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

ECY008 OPTICAL COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVE:

To impart the knowledge on

- The Optical network components for Optical Network communication.
- Various Network architecture and topologies for optical networks.
- The issues in the network design and operation for wavelength routing in optical networks.

UNIT I OPTICAL NETWORKING COMPONENTS 9

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

UNIT II SONET AND SDH NETWORKS 9

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

UNIT III BROADCAST – AND- SELECT NETWORKS 9

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

UNIT IV WAVELENGTH-ROUTING NETWORKS 9

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

UNIT V 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: 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.

OUTCOME:

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.

ECY009 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.

UNIT I FIELD ANALYSIS OF PLANAR TRANSMISSION LINES 9

Microstrip Transmission Lines – Attenuation – High frequency properties of Microstrip lines. Coupled Microstrip lines – even and odd modes. Strip transmission lines – Coupled strip lines – Fin lines.

UNIT II CIRCUIT THEORY FOR WAVE GUIDE SYSTEMS 9

Equivalent voltages and currents – Impedance description of waveguide elements and circuits – one port circuit. Foster's reactance theorem. N-port circuits. Two port junctions. Excitation of waveguides. Probe coupling in rectangular waveguide. Radiation from linear current elements and current loops. Waveguide coupling by apertures.

UNIT III PERIODIC STRUCTURES AND FILTERS 9

Wave analysis of periodic structures. Periodic structures composed of Unsymmetrical two port networks. Terminated Periodic structures. Matching of Periodic structures. Floquet's theorem and spatial Harmonics. Microwave Filters – Image parameter method. Filter design by insertion loss method. Low pass filter design. Microstrip parallel coupled filter.

UNIT IV MICROWAVE SOLID STATE AMPLIFIERS 9

S-parameters - Unilateral design of amplifiers – simultaneous conjugate match. Bilateral design of amplifiers. Amplifier stability. Conditional and unconditional stability criteria. Amplifier power gain. Constant gain circles. Noise temperature concept. Noise factor and noise figure. Noise temperature for cascaded stages. Constant noise figure circles. Design of single stage microwave amplifiers.

UNIT V MICROWAVES AND OPTICS 9

Geometrical optics as a limiting case of wave optics. Ray matrices for paraxial ray optics. Gaussian beams. Generation of Gaussian beams at microwave frequencies. The beam waist. Propagation of Gaussian beams in Homogeneous medium. Transformation of Gaussian beams with lenses.

TOTAL : 45

REFERENCES

1. R.E.Collin, " Foundations for Microwave Engineering", McGraw-Hill, 1992.
2. Ramo, Whinnery and Van Duzer, "Fields and Waves in Communication Electronics". 3rd Edition., Wiley, 1997.
3. Pozar, David "Microwave & RF system", Wiley 2001
4. W.Tomasi, " Advanced Microwave Communication systems", PHI 2002, 2nd edition.

OUTCOME

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.
- Use of microwave theory concepts to develop new CAD software.
- Mastery of the use of microwave equipment such as network and spectrum analyzers.

EC Y010 SPEECH AND AUDIO SIGNAL PROCESSING **L T P C**
3 0 0 3

OBJECTIVE

- Fundamental concepts of speech production and speech perception
- Mathematical foundations of signal processing and pattern recognition
- Computational methods for speech analysis, recognition, synthesis, and modification

UNIT I MECHANICS OF SPEECH 9

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.

UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING 9

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.

UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 9

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

UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH 9

Formulation of Linear Prediction problem in Time Domain - Basic Principle - Auto correlation 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.

UNIT V APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING 9

Algorithms: Spectral Estimation, dynamic time warping, hidden Markov model - Music analysis - Pitch Detection - Feature analysis for recognition - Music synthesis - Automatic Speech Recognition - Feature Extraction for ASR - Deterministic sequence recognition - Statistical Sequence recognition - ASR systems - Speaker identification and verification - Voice response system - Speech Synthesis: Text to speech, voice over IP.

TOTAL : 45

REFERENCES

1. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc. , Singapore, 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 - 2nd edition - Berlin - 1972
5. I.H.Witten - Principles of Computer Speech - Academic Press - 1982

OUTCOME

On completion of this course the student will be able to

- Manipulate, visualize, and analyze speech signals
- Perform various decompositions, codifications, and modifications of speech signals
- Build a complete speech recognition system using state of the art tools

ECY011 COMMUNICATION NETWORK SECURITY

	L	T	P	C
	3	0	0	3

OBJECTIVE:

- 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

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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 : 45

REFERENCES

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

OUTCOME:

On completion of this 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.

ECY012 WIRELESS COMMUNICATIONS NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVE

- To introduce the concepts of wireless / mobile communication using cellular environment.
- To make the students to know about the various modulation techniques, propagation methods, coding and multi access techniques used in the wireless communication.

UNIT I INTRODUCTION 7

Current wireless systems, the wireless spectrum and allocation to existing systems, radio propagation models, path loss calculation, ray tracing methods, empirical path loss models, discrete time and space time channel models, capacity of AWGN, flat fading, and frequency selective fading channels.

UNIT II OFDM 9

Generation of sub-carriers using the IFFT; Guard Time and Cyclic Extension; Windowing; OFDM signal processing; Peak Power Problem: PAP reduction schemes-Clipping, Filtering, Coding and Scrambling.

UNIT III MULTIPLE ANTENNA SYSTEMS 10

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 anetnnas.

UNIT IV EQUALIZATION AND MULTICARRIER MODULATION 12

Equalizer noise enhancement and types, folded spectrum and ISI free transmission, linear equalization and MLSE, DFE and adaptive equelizers, data transmission using multiple carriers and, mitigation of subcarrier fading, discrete implementation of multicarrier systems, matrix rpreentation of OFDM, PAPR and frequency and timing offset.

UNIT V SPREAD SPECTRUM AND MULTI USER DETECTION 7

DSSS, FHSS and multiuser versions of these, random access, power control, downlink channel capacity, uplik channel capacity, multiuser diversity, MIMO diversity.

TOTAL: 45 PERIODS

REFERENCES

1. Wireless Communication , Andrea Goldsmith, 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.

OUTCOME

On completion of this course the student will understand

- Second generation and third generation wireless networks and worldwide wireless standards.
- Analog and digital modulation techniques used in wireless communication.
- The fundamental cellular radio concepts such as frequency reuse and handoff.
- Different ways to radio propagation models and predict the large – scale effects of radio propagation in many operating environment.
- The different types of equalization techniques and diversity concepts.

ECY013 MEDICAL IMAGE PROCESSING

	L	T	P	C
	3	0	0	3

OBJECTIVE:

- 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.

UNIT I IMAGE FUNDAMENTAL 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.

UNIT 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

UNIT III MEDICAL IMAGE RECONSTRUCTION 9

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

UNIT 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

UNIT 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: 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 Jnathan M.Links,” Medical Imaging Signals and Systems”- Pearson Education Inc. 2006

OUTCOME:

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.

CSY002 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing

UNIT I ARTIFICIAL NEURAL NETWORKS 9

Basic concepts-single layer perceptron-Multi layer perceptron-Adaline-Madaline-Learning rules-Supervised learning-Back propagation networks-Training algorithm, Practical difficulties, Advanced algorithms-Adaptive network- Radial basis network-modular network-Applications

UNIT II UNSUPERVISED NETWORKS 9

Introduction- unsupervised learning -Competitive learning networks-Kohonen self organising networks-Learning vector quantisation - Hebbian learning - Hopfield network-Content addressable nature, Binary Hopfield network, Continuous Hopfield network Travelling Salesperson problem - Adaptive resonance theory –Bidirectional Associative Memory-Principle component Analysis.

UNIT III FUZZY SYSTEMS 9

Fuzzy sets-Fuzzy rules: Extension principle, Fuzzy relation- fuzzy reasoning – fuzzy inference systems: Mamdani model, Sugeno model. Tsukamoto model -Fuzzy decision making- Multiobjective Decision Making-Fuzzy classification-Fuzzy control methods -Application.

UNIT IV NEURO-FUZZY MODELLING 9

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress, Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C means clustering, Mountain clustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real –Time Recurrent Learning.

UNIT V GENETIC ALGORITHM 9

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest-crossover-Inversion and Deletion-mutation-reproduction-Generational cycle-rank method-rank space method- Other derivative free optimization-simulated annealing, Random search, Downhill simplex search-Application

TOTAL : 45

REFERENCES

1. Jang J.S.R.,Sun C.T and Mizutani E – "Neuro Fuzzy and Soft computing", Pearson education (Singapore) 2004
2. David E.Goldberg : "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, Asia,1996
3. Laurene Fauseett:"Fundamentals of Neural Networks", Prentice Hall India, New Delhi,1994.
4. Timothy J.Ross:"Fuzzy Logic Engineering Applications", McGrawHill, NewYork,1997.
5. S.Rajasekaran and G.A.Vijayalakshmi Pai "Neural networks,Fuzzy logics,and Genetic algorithms", Prentice Hall of India,2003
6. George J.Klir and Bo Yuan,"Fuzzy Sets and Fuzzy Logic",Prentice Hall Inc., New Jersey,1995

OUTCOME:

On completion of the course, students will be able to

- Develop systems that encapsulate human expertise.
- Admit approximate reasoning, imprecision, uncertainty and partial truth in order to mimic the remarkable human capability of making decisions in real-life, ambiguous environments.
- Use the applications of soft computing techniques in Biomedical Application, Intelligent Instrumentation, Defense Application, Fault Tolerance System, Critical application area

CSY081 **NETWORK MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVE

- Understand the fundamental concepts of network management
- Exposure to network security aspects
- To understand about the architecture, standard and services of broadband networks

UNIT I FUNDAMENTALS OF COMPUTER NETWORK TEHNOLOGY 9

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

UNIT 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

UNIT 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.

UNIT 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, Intergrated

Management Interface. ATM Management Information base, Role of SNMD and ILMIin Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management.

UNIT 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 : 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 Mnagement", Eastern Economy Edition IEEE Press, New Delhi, 1999.

OUTCOME:

On completion of the course the student will gain knowledge.

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

CSY082 INTERNETWORKING MULTIMEDIA

	L	T	P	C
	3	0	0	3

OBJECTIVE:

To study

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

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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 : 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, 4ed, Tata McGraw Hill, New Delhi, 2000.
4. K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, Multimedia Communication systems, PHI 2003

OUTCOME:

On completion of this course the student will understand

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

CSY 083 HIGH SPEED SWITCHING ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVE

To make the students to have a depth knowledge of High Speed networks, ATM, LAN and IP switching concepts.

UNIT I HIGH SPEED NETWORK 9

Introduction-LAN, WAN, Network evolution through ISDN to B-ISDN, Transfer mode and control of B-ISDN, SDH Multiplexing structure, ATM standard, ATM adaptation layers.

UNIT II LAN SWITCHING TECHNOLOGY 9

Switching concepts, switch forwarding techniques, switch path control, LAN switching, cut through forwarding, store and forward, Virtual LANs.

UNIT III ATM SWITCHING ARCHITECTURE 9

Switch model, Blocking Networks - basic- and-enhanced banyan networks, sorting networks – merge sorting, re-arrangable networks- full- and-partial connection networks, non blocking networks-Recursive network construction, comparison of non blocking network, switching with deflection routing – shuffle switch, tandem banyan.

UNIT IV QUEUES IN ATM SWITCHES 9

Internal queueing-Input, Output and shared queueing, Multiple Queueing networks- combined Input, Output and shared queueing – Performance analysis of Queued Switches.

UNITV IP SWITCHING 9

Addressing model, IP Switching types – flow driven and topology driven solutions, IP over ATM address and next hop resolution, multicasting, IPv6 Over ATM.

TOTAL: 45

REFERENCES

1. Achille Pattavina, Switching Theory: Architectures and Performance in Broadband ATM Networks" Jhon wiley & Sons Ltd, New York. 1998

2. Christopher Y Metz, Switching Protocols and Architectures, McGraw - Hill Professional Publishing, New York. 1998

3. Rainer Handel,Manfred N Huber,Stefan Schroder,ATM Networks- Concepts, Protocols, Appliations III Edition, Addison Wesley, New York. 1999

4. John A. Chiong: Internetworking ATM for the internet and enterprise networks. McGraw - Hill New York. 1998

OUTCOME

On completion of this course the student will understand

- Detailed idea about High Speed Networks.
- Various Switching Concepts employed in ATM Networks
- Analyze and compare the different switching techniques in ATM, LAN and IP Switching networks.

ECY 014	INTERNET DENIAL OF SERVICE	L T P C
		3 0 0 3

OBJECTIVE

Denial of service attacks aim at crippling applications, servers and old networks distrupting legitimate users communication

UNIT -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.

UNIT -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.

UNIT- III DEFENSE APPROACHES 9

Thinking about defenses- 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.

UNIT -IV SURVEY OF DEFENSE RESEARCH APPROACHES 9

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

UNIT -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 No of periods: 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, NewYork 008.
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

OUTCOME

On completion of this course the student will understand

- New threat in DOS and DdoS atttacks
- To prepare for these attacks, preventing them when possible, dealing with them when they occur

ECY 015 QOS IN AD HOC WIRELESS NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVE

The course is designed with a purpose of developing knowledge in Medium access protocol, Ad-hoc networks,and design of routing protocols.

UNIT -I INTRODUCTION 9

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

UNIT -II MEDIUM ACCESS PROTOCOLS 9

MAC Protocpls: 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.

UNIT -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.

UNIT -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.

UNIT-V QOS IN AD-HOC NETWORKS 9

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

TOTAL =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]

OUTCOME:

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

- The fundemental concepts, design issues , solution for the issues , architecture
- Protocols of ad hoc wireless networks,
- QoS and energy manangement in ad hod wireless networks .