SYLLABUS
(with effect from 2014-2015)

ಪಠ್ಯಕ್ರಮ
ಶೈಕ್ಷಣಿಕ ವರ್ಷ ೨೦೧೪–೨೦೧೫ ರಿಂದ

Master of Technology in
DIGITAL ELECTRONICS & COMMUNICATION

Visvesvaraya Technological University
"Jnana Sangama", Belagavi - 590018, Karnataka.
ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ
"ಜ್ಞಾನಸಂಗಮ", ಬೆಳಗಾವಿ ೫೯೦೦೧೮, ಕರ್ನಾಟಕ

Syllabus of I to IV Semesters

(With effect from 2014-2015)

Master of Technology in

DIGITAL ELECTRONICS & COMMUNICATION

Visvesvaraya Technological University, Belagavi

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ

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THE MASTER OF TECHNOLOGY COURSE IN ENGINEERING
(Full Time / Part Time)

OM 1 **TITLE OF THE COURSE**

OM 1.1 The Course shall be called Master of Technology Course, abbreviated as M.Tech. (Subject of Specialization)

OM 2 **DURATION OF THE COURSE**

OM 2.1 There shall be two categories:

1) Full Time Course and

2) Part Time Course

OM 2.2 **Full Time Course:**

The course shall extend over a period of four semesters and each semester shall have the following schedule:

First Semester: 23 weeks duration

- 16 weeks course work +7 weeks for (Preparation, Examination and Vacation).

Second Semester: 21 weeks duration

- 16 weeks course work +5 weeks for (Preparation, Examination and Vacation).

Third Semester: 21 weeks duration

- 16 weeks Internship +5 weeks for (Report Submission, Evaluation, Viva-Voce and initiation of Project Phase-II).
- *Seminar and Presentation on Internship after 8 weeks from the commencement of III Semester.*
- *Report on Internship.*
- *Project Phase- I: Problem formulation and submission of synopsis within 8 weeks from the commencement of 3rd semester to the HoD with the approval of the Project Guide.*
- *Evaluation of Internship report and Viva-Voce, and*
- *Project Phase- II: Preliminary work on Project Implementation.*

Fourth Semester: 24 weeks duration

Course work of 2 subjects +Project Phase-III

OM 2.3 **Part Time Course:**

(a) The course shall extend over 6 semesters.

(b) Each semester shall be of the duration equivalent to that of the semester for full time students, inclusive of teaching, preparation for examination and vacation.

(c) First, second, third & fourth semester shall comprise of course work and the fifth shall be entirely devoted to Internship and sixth semester shall be entirely devoted to dissertation work.

(d) During the first semester, the candidate shall register for the subjects of first and third semesters. During the second semester, the candidate shall register for the subjects of second and fourth semesters.

(e) The candidate shall register for a maximum of three subjects per semester.

(f) The candidates shall register for Lab subject in first and second semesters along with the regular three subjects.

OM 2.4 A Full Time candidate shall be allowed a maximum duration of eight semesters from the first semester of admission to become eligible for the award of Master's Degree, failing which he/she may register once again as a fresh candidate.

OM. 2.5 A Part Time candidate shall be allowed a maximum of 12 semesters duration from the first semester of admission to become eligible for the award of Master's Degree, failing which he/she may register once again as a fresh candidate.

OM 2.6 The Calendar of events in respect of the course shall be fixed by the University from time to time.

OM 3 **ELIGIBILITY FOR ADMISSION**

OM 3.1 Admission to the Master of Technology Course shall be open to all the candidates who have passed B.E. / B. Tech. Examinations (as per the eligibility criteria specified from time to time) of VTU or any other recognized University / Institution. The decision of the Equivalence committee shall be final in establishing the eligibility of candidates for a particular course.

For the foreign degrees Equivalence certificate from the Association of Indian Universities is a must.

However, the candidates who have completed their prerequisite degree through the distance mode education are not eligible for admission to M.Tech. Courses under any quota i.e. Govt./Management.

OM 3.2 AMIE qualification in respective branches shall be equivalent to B.E./ B. Tech. Courses of VTU for admission to M.Tech. However, the candidate seeking admission to M.Tech. courses on the basis of AMIE shall also take the Common Entrance Test.

OM 3.3 Admission to M.Tech. Course shall be open to the candidates who have passed the prescribed qualifying examination with not less than 50% of the marks in the aggregate of all the years of the degree examination. However, in the case of candidates belonging to SC/ST and Category I, the aggregate percentage of marks in the qualifying examinations shall not be less than 45%. Rounding off of percentage secured in qualifying examination is not permissible.

OM3.4 *There shall be entrance examination for PG Programs from the Karnataka Examination Authority and candidates qualified for the admission through the Entrance examination or qualified for admission under GATE and issued an admission order from KEA are eligible for the admission to M.Tech. Program or through the entrance examination conducted by the University.*

For admissions under Management Quota:

The candidates should have appeared for the Entrance Examination conducted by KEA or Qualified under GATE or appeared and qualified through the entrance examination conducted by the University.

Further, there shall be an Admissions Committee for PG Course in each college for each branch of PG studies consisting of the Principal of the College as the Chairman, Head of the concerned Department, one senior staff member of the concerned Department. The Admissions Committee conducts the interview of the candidates for admissions.

For admissions under Sponsored Quota:

The candidates should have appeared for the Entrance Examination conducted by KEA or Qualified under GATE or through the entrance examination conducted by the University.

OM 3.5 The candidates, who have qualified in the GATE Examination for the appropriate branch of engineering, shall be given priority. They shall be exempt from taking Entrance Examination.

OM 3.6 If sufficient number of GATE qualified candidates are not available, such seats shall be filled from amongst the candidates appeared for Entrance Examination in the order of merit.

OM 3.7 The maximum number of seats under various categories (regular, sponsored candidates and SC/ST) shall be as sanctioned by the AICTE, State Government and VTU, from time to time.

OM 3.8 Subject to the provisions of OM 3.1 and OM 3.2, members of the Teaching/Research Staff/Teaching Assistants working in any Engineering College recognized by AICTE either in the State of Karnataka or outside and who have put in a minimum of Three years of teaching experience on full-time basis in Engineering Colleges, Polytechnic institutions / any other institutions imparting Engineering education shall be eligible for admission to PG Courses under sponsored quota, if they are sponsored by the respective Institutions / DTE. Where sufficient number of such candidates is not available, candidates with minimum Three years of teaching experience may be allowed to the course against sponsored quota.

OM 3.9 Subject to the provisions of OM3.1 and OM3.2, members working in the State Government / Central Government / Quasi Government Organizations / Public Sector Industries / Reputed Private Industries, who have put in a minimum of Three years of working experience and are sponsored by the concerned Organizations shall also be eligible to seek admissions to PG Courses against sponsored quota.

OM 3.10 The Engineering graduates other than the graduates of any of the Universities of Karnataka State shall have to obtain Eligibility Certificate from the VTU to seek admission to P.G. course in any of the colleges affiliated to VTU.

OM 3.11 Part time students whose place of working is within radial distance of 40 km from the institution where they seek admission shall take admission for the course under the regulation OM 3.8 or OM3.9.

OM 3.12 Admission to M.Tech. course shall be open under lateral entry scheme for candidates who have completed one year PG Diploma Course of VTU or equivalent course in that branch in which he / she is seeking admission and satisfies all other eligibility criteria for admission to the regular M.Tech. Course.

OM 4 ATTENDANCE REQUIREMENT

OM 4.1 Each course of the semester shall be treated as a separate unit for calculation of the attendance.

OM 4.2 Each semester is considered as a unit and the candidate has to put in a minimum attendance of 85% in each subject with a provision of condonation of 10% of the attendance by the Vice-Chancellor on the specific recommendation of the Principal of the college where the candidate is studying, showing some reasonable cause such as medical grounds, participation in University level sports, cultural activities, seminars, workshops, paper presentation, etc. The necessary documents such as Medical Certificate, letter of participation in University level activities etc., are to be submitted along with recommendations for condonation.

OM 4.3 A candidate, who does not satisfy the attendance requirement as mentioned above shall not be eligible to appear for the Examination of that semester and shall be required to repeat that semester along with regular students during the subsequent year.

OM 4.4 If a candidate, for any reason, discontinues the course in the middle, he/she may be permitted to register to continue the course along with subsequent batch, subject to the condition that he/she shall complete the class work, laboratory work and seminar including the submission of dissertation within the maximum stipulated period (double the duration of the course). Such candidate shall not be eligible to be considered for the award of rank.

OM 4.5 Principals of the concerned colleges shall notify regularly, the list of such candidates who fall short of attendance.

OM 4.6 The list of the candidates falling short of attendance shall be sent to the University at least one week prior to the commencement of the examination.

OM 5 INTERNAL ASSESSMENT

OM 5.1 A candidate shall obtain not less than 50% of the maximum marks prescribed for the Internal Assessment (IA) of each subject/Lab, including seminars.

OM 5.2 Internal Assessment Marks shall be based on assignments, tests, oral examination and seminar conducted in respective subjects (minimum of two tests are compulsory).

OM 5.3 Candidates obtaining less than 50% of the Internal Assessment marks in any subject(s)/Lab shall not be eligible to appear for the examination in that subject(s). Only in such cases, the Head of the Department shall arrange for the improvement of Internal Assessment marks in the subject(s)/Lab in subsequent semester.

OM 5.4 The candidates shall write the Internal Assessment Test in Blue Books which shall be maintained by the Principal / Head of the Department for at least **three months** after the announcement of University results and available for verification as per the directions of the Registrar (Evaluation).

OM 5.5 Every sheet of the Internal Assessment marks list shall bear the signatures of the concerned Teacher, Head of the Department and the Principal.

OM 5.6 The Internal Assessment marks list shall be displayed on the Notice Board and corrections, if any, shall be incorporated before sending to the University.

OM 5.7 The IA marks shall be sent to the university by the Principals well in advance before the commencement of theory examination. No corrections of the Internal Assessment marks shall be entertained after the submission of marks list to the University.

OM 6 **SEMINARS**

OM 6.1 All candidates shall present one seminar each in the first and the second semesters on the topics chosen from the relevant fields.

OM 6.2 The Head of the Department shall arrange for conducting such seminars through concerned faculty member of the Department.

OM 6.3 The Internal Assessment marks for the seminar shall be awarded by the concerned faculty member.

OM 7 **PAPER SETTING AND EVALUATION OF THEORY ANSWER PAPERS**

OM 7.1 Question papers in theory subjects shall be set by the Examiners appointed for that purpose by the University.

OM 7.2 There shall be double valuation of theory papers. The theory Answer booklets shall be valued independently by two examiners appointed by the University.

OM 7.3 If the difference between the marks awarded by the two Examiners is not more than 15 per cent of the maximum marks, the marks awarded to the candidate shall be the average of two evaluations.

OM 7.4 If the difference between the marks awarded by the two Examiners is more than 15 per cent of the maximum marks, the answer booklet shall be evaluated by a third Examiner appointed by the university. The average of the marks of nearest two valuations shall be considered as the marks secured by the candidate. However, if one of the three marks falls exactly midway between the other two, then the highest two marks shall be taken for averaging.

0M 8 **Internship**

OM 8.1 **Internship:** The student shall undergo Internship for 16 weeks.

OM 8.2 **Seminar / Presentation on Internship**: The student shall make a midterm presentation of the activities undertaken during the first eight weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department of the college.

OM 8.3 **Report on Internship**: The College shall facilitate and monitor the student internship program. The internship report of each student shall be submitted to the Head of the Department of the college with the approval of the Guide.

OM 8.4 **Evaluation of Internship** - To be carried out by the Internal Guide of the college and the respective Head of the Department.

OM 8.5 **Viva-Voce on Internship Report-** To be conducted *internally* by the Internship Guide (from the college) and the External Guide under whose supervision the student has carried out the internship.

OM 8.6 Failure to undergo Internship: The student will not be eligible to submit the dissertation

OM 9 **DISSERTATION WORK**

OM 9.1 The candidate shall submit a soft copy of the dissertation work in the form of CD which should contain the entire Dissertation in monolithic form as a PDF file (not separate chapters)

Guide after checking the report for completeness shall upload the Dissertation along with name, address, mobile number of the candidate, etc. as prescribed in form available on online Dissertation evaluation portal. The guide shall also chose and submit a panel of four expert evaluators.

OM 9.2 **Plagiarism Check**

Once the Guide uploads the dissertation, The dissertation shall be linked for plagiarism check and the plagiarism index <=25%.

If the report indicates plagiarism index >25% :

for the **first** time the candidate has to resubmit the dissertation along with the penal fees of Rs 2000/- (Two thousand only) in person.

for the **second** time the candidate has to resubmit the dissertation along with the penal fees of Rs 4000/- (four thousand only) in person.

If the dissertation is rejected again during second resubmission, the candidate shall redo the project and submit after a semester's time.

OM 9.3 The date of submission of the dissertation may be extended up to a maximum of four academic years for full-time students and maximum of six academic years for part-time students, from the date of commencement of the first semester in which the candidate has taken admission to the course.

OM 9.4 The dissertation shall be sent through email for evaluation to two examiners - one internal examiner (guide/co-guide) and one external examiner appointed by the University. The evaluation of the dissertation shall be made independently by each examiner.

OM 9.5 The examiners shall independently evaluate and submit the marks through the specified link.

OM 9.6 Average of the marks awarded by the two Examiners shall be the final.

OM 9.7

Examiners shall evaluate the dissertation normally within a period of not more than three weeks from the date of receipt of dissertation through email. The dissertation shall not be accepted for passing if external examiner finds that the dissertation work and the report is not up to the expected standard and the minimum passing marks cannot be awarded. The external examiner can totally reject the dissertation or ask for its modification. The examiner shall give reasons for rejection of the dissertation or requiring its modification and where modification in the dissertation is required, he / she can make suggestion for improvement of the dissertation for resubmission. In cases where modification is recommended after incorporating suggestions, the dissertation report shall be sent to the same external examiner.

OM 9.8

If the examiner does not approve the dissertation on its re-submission, it shall be treated as rejected. After the rejection by the first external examiner, it shall be sent to a second examiner appointed by the University. If the second examiner also does not approve the dissertation, the candidate shall have to carry out the dissertation work once again and shall submit the dissertation within the stipulated time. In such cases of Rejection, the candidate shall redo the entire procedure from the submission of Dissertation in soft copy.

OM 9.9

The candidate may also choose another topic of dissertation under a new guide, if necessary. In such an event, the report shall be submitted within four years in case of full time student and six years in case of part time student respectively from the date of admission to the course.

OM 9.10

If the dissertation report is approved and evaluated by both the examiners and the candidate secured minimum passing marks in the evaluation, the office of the Registrar (Evaluation) will send the link to both the examiners for the conduct of Viva-Voce Exam and submission of marks.

Internal examiner as per the direction of the University to arrive at a mutually convenient date for the conduct of *viva-voce* examination of the concerned candidate with intimation to the Registrar (Evaluation). In case one of the examiners expresses his inability to attend the *viva-voce*, the Registrar (Evaluation) shall appoint a substitute examiner in his place.

OM 9.11 The relative weightage for the evaluation of dissertation and the performance at the *viva voce* shall be as per the scheme of teaching & examination.

OM 9.12

The marks awarded by both the Examiners at the *viva voce* Examination shall be sent jointly to the University immediately after the examination.

Examination fee as fixed from time to time by the University for evaluation of dissertation report and conduct of *viva voce* shall be remitted through the Head of the Institution as per the instructions sent by the office of Registrar (Evaluation) from time to time.

OM 9.13 If the dissertation report is approved, as per regulation OM8.11, a *viva-voce* examination of the candidate shall be conducted by the external examiner and internal examiner / guide. The external examiner, who will be appointed by the University, shall be contacted by the Principal / Head of the Department.

Internal examiner as per the direction of the University shall have to arrive at a mutually convenient date for the conduct of *viva-voce* examination of the concerned candidate with an intimation to the Registrar (Evaluation). In case one of the examiners expresses his/her inability to attend the *viva-voce*, the Registrar (Evaluation) shall appoint a substitute examiner in his/her place.

OM 9.14 The relative weightage for the evaluation of dissertation and the performance at the *viva voce* shall be as per the scheme of teaching & examination.

OM 9.15

The marks awarded by both the Examiners at the *viva voce* Examination shall be sent jointly to the University immediately after the examination.

OM 9.16 Examination fee as fixed from time to time by the University for evaluation of dissertation report and conduct of *viva voce* shall be remitted through the Head of the Institution as per the instructions sent by the office of Registrar (Evaluation) from time to time.

OM 10 **ELIGIBILITY FOR PASSING**

OM 10.1 There shall be University examination at the end of each semester.

OM 10.2 The candidate shall obtain a minimum of 40% of marks in each theory paper in the University examination and a minimum of 50% of marks in each laboratory examination and a minimum of 50% of marks in aggregate including the Internal Assessment marks for pass in each of the theory subject /Lab.

OM 10.3 To pass a candidate shall obtain a minimum of 50% of maximum marks separately both in Seminar and in Dissertation.

OM 10.4 The candidate with a maximum of two backlog subjects of first year shall be eligible for taking admission to second year (III semester).

However for part time course, candidate with one backlog subject shall be eligible for taking admission to odd semester from even semester.

OM 10.5 The full time candidate has to pass in all the subjects of the first two semesters **and Internship** and the part time candidate has to pass in all the subjects of first four semester **and Internship** before the submission of dissertation report.

OM 10.6 A candidate may at his/her desire reject his/her latest semester results of University examination in respect to all subjects of that semester. However, in the 4th semester the rejection shall not include the Dissertation result. Rejection shall be permitted only once during the entire course. The Internal Assessment marks of the rejected semester shall be retained.

If the rejection of the University examination results of the semester happens to be of an odd semester, the candidate can take admission to the immediate next even semester. However, if the rejection of the University result is of even semester, the candidate cannot take admission to the next odd semester.

OM 10.7 Application for rejection shall be submitted to the Registrar (Evaluation) through the Principal of the college, within thirty days from the date of announcement of results.

OM 10.8 A candidate, who opts for rejection shall be eligible for the award of class and distinction, but shall not be eligible for the award of rank.

OM 11 **Award of credits** A candidate, who satisfactorily completes a subject/lab /seminar/project/internship shall be awarded the credits prescribed for the subject/lab/seminar/project/internship.

OM 12 **AWARD OF CLASS AND RANK**

OM 12.1 Candidates who have complied to the academic requirements for the award of the degree of Master of Technology shall be declared to have passed the course.

OM 12.2 The class shall be awarded at each semester based on the aggregate marks of the semester obtained in the first attempt.

OM 12.3 A candidate who secures 70% or more marks in the aggregate in the first attempt shall be declared to have passed in First class with Distinction.

OM 12.4 A candidate who secures 60% or more marks but less than 70% marks in the aggregate in the first attempt shall be declared to have passed in First Class.

OM 12.5 A candidate who secures 50% or more marks but less than 60% marks in the aggregate in the first attempt shall be declared to have passed in Second Class.

OM 12.6 The class shall be awarded on the aggregate marks obtained in the first attempt in all semesters.

OM 12.7 There shall be three ranks in each PG course, provided the minimum full time strength is 10. The ranks shall be declared only for full time students who have passed every semester in the first attempt, on the basis of the aggregate marks of all the semesters taken together.

OM 12.8 Candidates who have rejected as per the regulation OM9.6 or discontinued the course as per regulation OM4.4 or do not submit the dissertation report within the stipulated period as per OM 2.2 are not eligible for award of ranks.

NOTE: These regulations governing the Degree of Master of Technology of Visvesvaraya Technological University shall be binding on all and may be modified from time to time.

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. in Digital Electronics & Communication

I Semester **CREDIT BASED**

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14ELD11	Advanced Mathematics	4	2	3	50	100	150	4
14ECS12	Antenna Theory and Design	4	2	3	50	100	150	4
14ECS13	Probability and Random Process	4	2	3	50	100	150	4
14ECS14	Advanced Digital Communication	4	2	3	50	100	150	4
14ECS15X	Elective - I	4	2	3	50	100	150	4
14ECS16	DEC Lab -1	--	3	3	25	50	75	2
14ECS17	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
	Total	**20**	**16**	**18**	**300**	**550**	**850**	**23**

Elective-I

14 ECS 151	Wireless and Mobile Networks	14 ECS 154	CMOS VLSI Design
14 ELD 152	Automotive electronics	14 ELD155	Simulation, Modeling, and Analysis
14 ELD153	Nanoelectronics		

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II Semester **CREDIT BASED**

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14ECS21	Wireless Communication	4	2	3	50	100	150	4
14ECS22	RF and Microwave circuit design	4	2	3	50	100	150	4
14ECS23	Modern DSP	4	2	3	50	100	150	4
14ECS24	Optical Communication and Networking	4	2	3	50	100	150	4
14ECS25X	Elective-II	4	2	3	50	100	150	4
14ECS26	DEC Lab -2		3	3	25	50	75	2
14ECS27	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
	Total	**20**	**16**	**18**	**300**	**550**	**850**	**23**

Elective -II

14 ECS 251	Broadband Wireless networks	14 ECS 254	Multimedia Communication
14 ECS 252	ASIC design	14 ECS 255	Spread Spectrum Communication
14 ECS 253	Advanced Embedded system		

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III Semester: INTERNSHIP **CREDIT BASED**

Course Code	Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14ECS31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement of the semester).	-	-	-	25	-	25	
	Project Phase: I – Problem formulation and submission of synopsis within 8 weeks from the commencement of 3rd semester.	-	-	-	-	-	-	
14ECS32	**Evaluation of Internship** - To be carried out by the Internal Guide of the college and the respective Head of the Department.	-	-	-	50		50	
14ECS33	**Viva-Voce on Internship Report-** To be conducted *internally* by the Internship Guide (from the college) and the External Guide under whose supervision the student has carried out the internship.	-	-	-	-	75	75	
	Project Phase: II – Preliminary work on Project Implementation.	-	-	-	-	-	-	
	Total	**-**	**-**	**-**	**75**	**75**	**150**	**20**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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IV Semester **CREDIT BASED**

Subject Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Field Work / Assignment / Tutorials		I.A.	Exam		
14ECS41	Error control coding	4	2	3	50	100	150	4
14ECS42X	Elective-III	4	2	3	50	100	150	4
14ECS43	Interim Evaluation of Project work (after 10 weeks from the commencement of 4th Semester).	-	-	-	50	-	50	2
14ECS44	Final Evaluation of Project Work and Viva-voce.	–	-	3	-	100+100	200	18
	Total	**8**	**04**	**09**	**150**	**400**	**550**	**28**
						Grand Total (I to IV Sem.): 2400 Marks; 94 Credits		

Elective -III:

14 ECS 421	RF MEMS	14 ECS 424	Communication System design using DSP algorithm
14 ECS 422	Advanced Computer Networks	14 ECS 425	Advanced Radar systems
14 ECS 423	Advances in VLSI Design		

NOTE:

III Semester:

1. **Internship:** The student shall undergo Internship for 16 weeks.
2. **Seminar / Presentation on Internship**: The student shall make a midterm presentation of the activities undertaken during the first eight weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department of the college.
3. **Project Phase: I -** Problem formulation and submission of synopsis of Project to the Head of the Department of the college with the approval of the Guide **within eight weeks** from the commencement of III Semester.
4. **Report on Internship**: The College shall facilitate and monitor the student internship program. The internship report of each student shall be submitted to the Head of the Department of the college with the approval of the Guide.
5. **Evaluation of Internship** - To be carried out by the Internal Guide of the college and the respective Head of the Department.
6. **Viva-Voce on Internship Report-** To be conducted *internally* by the Internship Guide (from the college) and the External Guide under whose supervision the student has carried out the internship.
7. **Project Phase : II -** Preliminary work on Project Implementation.

IV Semester:

8. **Interim Evaluation of Project** : Comprising Evaluation of Project Phase –I and Project Phase – II – **By Internal Guide after Ten weeks from the commencement of Fourth Semester.**
9. **Project Phase-III** : Finalization of Project work, dissertation report writing and submission of dissertation report.
10. **Evaluation of Dissertation / Final Project:**
    1. Final evaluation of project to be carried out after 24 weeks from the date of commencement of 4th semester.
    2. The Internal Examiner (the project guide with a teaching experience of at least three years) and External Examiner shall be appointed by the University for the final evaluation of Project.
    3. Internal Examiner shall carry out the evaluation for 100 Marks, and
    4. External Examiner, shall carry out the evaluation for 100 Marks.
11. The average of the marks allotted by the Internal Examiner and the External examiner shall be the final marks of the Project Evaluation.
12. **Viva – Voce** : The Viva-Voce shall be conducted jointly by Internal Examiner and External Examiner for 100 Marks.

ADVANCED MATHEMATICS

Subject Code	**: 14ELD11**	**IA Marks**	**: 50**
No. of Lecture Hours Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Matrix Theory

QR EL Decomposition – Eigen values using shifted QR algorithm- Singular Value EL Decomposition - Pseudo inverse- Least square approximations

Calculus of Variations

Concept of Functionals- Euler's equation – functional dependent on first and higher order derivatives – Functionals on several dependent variables – Iso perimetric problems- Variational problems with moving boundaries

Transform Methods

Laplace transform methods for one dimensional wave equation – Displacements in a string – Longitudinal vibration of a elastic bar – Fourier transform methods for one dimensional heat conduction problems in infinite and semi infinite rod.

Elliptic Equation

Laplace equation – Properties of harmonic functions – Fourier transform methods for laplace equations. Solution for Poisson equation by Fourier transforms method

Linear and Non Linear Programming

Simplex Algorithm- Two Phase and Big M techniques – Duality theory- Dual Simplex method. Non Linear Programming –Constrained extremal problems- Lagranges multiplier method- Kuhn- Tucker conditions and solutions

Reference Books:

1. Richard Bronson, **"Schaum's Outlines of Theory and Problems of Matrix Operations"**, McGraw-Hill, 1988.
2. Venkataraman M K, **"Higher Engineering Mathematics"**, National Pub. Co, 1992.

3. Elsgolts, L., **"Differential Equations and Calculus of Variations"**, Mir, 1977.

4. Sneddon,I.N., **"Elements of Partial differential equations"**, Dover Publications, 2006.

5. Sankara Rao, K., **"Introduction to partial differential equations"**, Prentice – Hall of India, 1995

6. Taha H A, **"Operations research - An introduction"**, McMilan Publishing co, 1982.

Antenna Theory and Design

Subject Code	**: 14ECS12**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Antenna fundamental and definitions: Radiation mechanism - overview, EM fundamentals, Solution of Maxwell's equations for radiation problems, Ideal dipole, Radiation patterns, Directivity and gain, Antenna impedance, Radiation efficiency, Antenna polarization.

Resonant Antennas: Wires and patches, Dipole antenna, Yagi-Uda antennas, Microstrip antenna.

Arrays: Array factor for linear arrays, Uniformly excited equally spaced linear arrays, Pattern multiplication, Directivity of linear arrays, Non-uniformly excited equally spaced linear arrays, Mutual coupling, Multidimensional arrays, Phased arrays, Feeding techniques, Perspectives on Arrays.

Broadband antennas: Travelling wave antennas Helical antennas, Biconical antennas Sleeve antennas, and Principles of frequency independent antennas, Spiral antennas, and Log - periodic antennas.

Aperture antennas: Techniques for evaluating gain, Reflector antennas - Parabolic reflector antenna principles, Axi-symmetric parabolic reflector antenna, Offset parabolic reflectors, Dual reflector antennas, Gain calculations for reflector antennas, Feed antennas for reflectors, FiECS representations, Matching the feed to the reflector, General feed model, Feed antennas used in practice.

Antenna Synthesis: Formulation of the synthesis problem, Synthesis principles, Line sources shaped beam synthesis, Linear array shaped beam synthesis, Fourier series, Woodward - Lawson sampling method, Comparison of shaped beam synthesis methods, low sidelobe narrow main beam synthesis methods, Dolph Chebyshev linear array, Taylor line source method.

Method of moments: Introduction of the methods moments, Pocklington's integral equation, Integral equation and Kirchhoff's networking equations, Source modeling weighted residual formulations and computational consideration, Calculation of antenna and scatter characteristics.

Computational EM: FTTD methods, Geometrical optics, Wedge diffraction theory, Ray fixed coordinate system, Uniform theory of wedge diffraction, E--plane analysis of horn antennas. Cylindrical parabolic antennas, Radiation by a slot on a finite ground plane, Radiation by a monopole on a finite

ground plane, Equivalent current concepts, Multiple diffraction formulation by a curved surfaces, Physical optics, Methods of stationary phase, physical theory of diffraction, Cylindrical parabolic reflector antennas.

Reference books:

1. C. A. Balanis, **"Antenna Theory Analysis and Design"**, John Wiley, 2nd edition, 1997.
2. J. D. Kraus, **"Antennas"**, McGraw Hill TMH, 3rd/4th edition.
3. Stutman and Thiele, **"Antenna theory and design"**, 2nd edition John Wiley and sons Inc.
4. Sachidnanda et al, **"Antennas and propagation"**, Pearson Education.

Probability and random Process

Subject Code	**: 14ECS13**	**IA Marks**	**: 50**
No. of Lecture HourWeek	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction to probability theory: Experiments, Sample space, Events, Axioms, Assigning probabilities, Joint and conditional, Baye's theorem, Independence, Discrete random variables, Engineering example

Random variables, Distributions, Density functions: CDF, PDF, Gaussian random variable, Uniform, Exponential, Laplace, Gamma, Erlang, Chi-square, Rayleigh, Rician and Cauchy types of random variables.

Operation on a single random variable: Expected value, EV of random variables, EV of functions of random variables, Central moments, Conditional expected values.

Characteristics functions: Probability generating functions, Moment generating function, Engineering applications, Scalar quantization, Entropy and source coding.

Pairs of random variables: Joint PDF, Joint probability mass functions, Conditional distribution, Density and mass functions, EV involving pairs of random variables, Independent random variables, Complex random variables, Engineering application.

Multiple random variables: Joint and conditional PMF, CDF, PDF, EV involving multiple random variables, Gaussian random variable in multiple dimension, Engineering application, Linear prediction.

Random process: Definition and characterisation, Mathematical tools for studying random processes, Stationery and Ergodic random processes, Properties of ACF.

Example Processes: Markov processes, Gaussian processes, Poisson processes, Engineering application, Computer networks, Telephone networks.

Reference books:

1) S.L.Miller and D.C.Childers, **"Probability and random processes: application to signal processing and communication"**, Academic press/Elsevier 2004.
2) A.Papoullis and S.U.Pillai, **"Probability, random variables and stochastic processes"**, McGraw Hill 2002

3) Peyton Z. Peebles, **"Probability, Random variables and random signal principles"**, TMH, 4th edition, 2007.

4) H Stark and Woods, **"Probability, random processes and application"**, PHI, 2001.

Advanced Digital Communication

Subject Code	**: 14ECS14**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Digital modulation techniques: Digital modulation formats, Coherent binary modulation techniques, Coherent quadrature - modulation techniques, No-coherent binary modulation techniques, Comparison of binary and quaternary modulation techniques, M-ray modulation techniques, Power spectra, Bandwidth efficiency, M-array modulation formats viewed in the light of the channel capacity theorem, Effect of inter symbol interference, Bit verses symbol error probabilities, Synchronization, Applications.

Coding techniques: Convolutional encoding, Convolutional encoder representation, Formulation of the convolutional decoding problem, Properties of convolutional codes: Distance property of convolutional codes, Systematic and nonsystematic convolutional codes, Performance Bounds for Convolutional codes, Coding gain, Other convolutional decoding algorithms, Sequential decoding, Feedback decoding, Turbo codes.

Communication through band limited linear filter channels: Optimum receiver for channel with ISI and AWGN, Linear equalization, Decision - feedback equalization, Reduced complexity ML detectors, Iterative equalization and decoding - Turbo equalization.

Adaptive equalization: Adaptive linear equalizer, adaptive decision feedback equalizer, Adaptive equalization of Trellis - coded signals, Recursive least square algorithms for adaptive equalization, Self recovering (blind) equalization.

Spread spectrum signals for digital communication: Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, Frequency hopped spread spectrum signals, CDMA, Time hopping SS, Synchronization of SS systems.

Digital communication through fading multipath channels: Characterization of fading multipath channels, The effect of signal characteristics on the choice of a channel model, Frequency nonselective, Slowly fading channel, Diversity techniques for fading multipath channels, Digital signals over a frequency selective, Slowly fading channel, Coded wave forms for fading channels, Multiple antenna systems.

Reference books:

1. John G. Proakis, **"Digital Communication"**, McGraw Hill, 4th edition, 2001.
2. Bernard Sklar, **"Digital Communication - Fundamental and applications"**, Pearson education (Asia), Pvt. Ltd., 2nd edition, 2001.
3. Simon Haykin, **"Digital communications"**, John Wiley and Sons.
4. Andrew J. Viterbi, **"CDMA: Principles of spread spectrum communications"**, Prentice Hall, USA, 1995.

ELECTIVE - I
Wireless and Mobile Networks

Subject Code	**: 14ECS151**	**IA Marks**	**: 50**
No. of Lecture HoursWeek	**: 04**	**Exam.Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Review of fundamentals of wireless communication and Networks: Wireless communication channel specifications, Wireless communication systems, Wireless networks, Switching technology, Communication problems, Wireless network issues and standards.

Wireless body area networks: Properties, Network architectures, Components, Technologies, Design issues, Protocols and applications.

Wireless personal area networks: Architectures, Components, Requirements, Technologies and protocols, Bluetooth and Zigbee.

Wireless LANs: Network components, design requirements, Architectures, IEEE-802.11x, WLAN protocols, 802.11p and applications.

WMANs, IEEE-802.16: Architectures, Components, WiMax mobility support, Protocols, Broadband networks and applications, WWANs, cellular networks, Satellite Network, Applications.

Wireless ad-hoc networks: Mobile ad-hoc networks, Sensor network, Mesh networks, VANETs, Research issues in Wireless networks.

Reference books

1. S. S. Manvi, and M. S. Kakkasageri, **"Wireless and Mobile network concepts and Protocols"**, Wiley, 1st edition, 2010.
2. P. Kaveh, Krishnamurthy, **"Principles of Wireless network: A unified approach"**, PHI, 2006.
3. Iti Saha Mitra, **"Wireless communication and network: 3G and Beyond"**, McGraw Hill, 2009.
4. Ivan Stojmenovic, **"Handbook of Wireless networks and Mobile Computing"**, Wiley, 2009.
5. P. Nicopolitidis, M. S. Obaidat, et al, **"Wireless Networks"**, Wiley, 2009.
6. Yi-Bing Lin, Imrich Chlamtac, **"Wireless and Mobile Network Architectures"**, Wiley, 2009.
7. Mullet, **"Introduction to Wireless Telecommunication Systems and Networks"**, Cengage, 2009.

Automotive Electronics

Subject Code	**: 14ELD152**	**IA Marks**	**: 50**
No. of Lecture Hours Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Automotive fundamentals overview - Four stroke cycle, Engine control, Ignition system, Spark plug, Spark pulse generation, Ignition timing, Drive train, Transmission, Brakes steering system, Battery, Starting system.
Air/Fuel system - Fuel handling, Air intake system, Air/Fuel management.

Sensors: Oxygen (O2/EGO) sensors, Throttle position sensor (TPS), Engine crankshaft angular position (CKP) sensor, Magnetic reluctance position sensor, Engine speed sensor, Ignition timing sensor, Hall effect position sensor, ShiECSed fiECS sensor, Optical crankshaft position sensor, Manifold absolute pressure (MAP) sensor - Strain gauge and capacitor capsule, Engine coolant temperature (ECT) sensor, Intake air temperature (IAT) sensor, Knock sensor, Airflow rate sensor, Throttle angle sensor.
Actuators: Fuel meeting actuator, Fuel injector, Ignition actuator.

Exhaust after treatment systems: Air, Catalytic converter, Exhaust gas recirculation (EGR), Evaporative emission systems.

Electronic engine control: Engine parameters, Variables, Engine performance terms, Electronic fuel control systems, Electronic ignition controls, Idle speed control, EGR control.
Communication: Serial data, Communication systems, Protection, Body and chassis electrical systems, Remote keyless entry, GPS.

Vehicle motion control: Cruise control, Chassis, Power brakes, Antilock brake systems, (ABS), Electronic steering control, Power steering, Traction control, Electronically controlled suspension.

Automotive instrumentation: sampling, Measurement and signal conversion of various parameters.
Integrated body: Climate control systems, Electronic HVAC systems, Safety systems SIR, Interior safety, lighting, Entertainment systems.

Automotive diagnostics: Timing light, Engine analyser, On-board diagnostics, off-board diagnostics, Expert systems.

Future automotive electronic systems: Alternative fuel engines, Collision avoidance radar warning systems, Low tire pressure warning system, Radio navigation, Advance driver information system.

Reference books

1) William B. Ribbens, **"Understanding Automotive Electronics"**, SAMS/Elsevier publishing, 6th edition.

2) Robert Bosch Gmbh, **"Automotive Electrics, Automotive Electronics Systems And Components"**, John Wiley and sons Ltd., 5th edition, 2007

Nanoelectronics

Subject Code	**: 14ELD153**	**IA Marks**	**: 50**
No.of LectureHoursWeek	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction: Overview of nanoscience and engineering, Development milestones in microfabrications and electronic industry, Moore's Law and continued miniaturization, Classification of nanostructures, Electronics properties of atoms and solids: Isolated atom, bonding between atoms, Giant molecular solids, Free electron models, Energy bands, Crystalline solids, Periodicity of crystal lattices, Electronic conduction, Effects of nanometer length scale, Fabrication methods: Top-down processes, Bottom-up processes methods for templating the growth of the nanomaterials, Ordering nanosystem.

Characterization: Classification, Microscopic techniques, FiECS ion microscopy, Scanning probe techniques, Diffraction techniques: Bulk, Surface spectroscopy techniques: Photon, radio frequency, electron, surface analysis and depth profiling; Electron mass ion beam reflectometry, Techniques for property measurements: Mechanical , Electron, Magnetic, Thermal properties.

Inorganic Semiconductor nanostructures: Overview of semiconductor physics, quantum confinement in semiconductor, nanostructures: Quantum wells, Quantum wires, Quantum dots, Superlattices, Band offsets, Electronic density of states.

Fabrication techniques: Requirement of ideal semiconductors, Epitaxial growth of quantum wells, Lithography and etching, Cleaved edge overgrowth of vicinal substrates, strain induced dots and wires, Electrostatically induced dots and wires, quantum well width fluctuations, Thermally annealed quantum wells, Semiconductor nanocrystals, Colloidal quantum dots, Self assembly techniques.

Physical processes: Modulation doping, Quantum hall effect, Resonant tunnelling, Charging effects, Ballistic carrier transport, Interband absorption, Intraband absorption, Light emission processes, Phonon bottleneck, Quantum confined stark effect, Nonlinear effects, Coherence and dephasing, characterization of semiconductor nanostructures: Optical, Electrical and structural.

Methods of measuring properties - Structure: Atomic, Crystallography, Microscopy, Spectroscopy. Properties of nanoparticles: Metal nanoclusters,

Semiconducting nanoparticles, Rare gas and molecular clusters, Methods of synthesis (RF, Chemical, Thermolysis, Pulse laser methods). Carbon nano structures and its applications (FiECS emission and shiECSing, Computers, Fuel cells, Sensors, Catalysis). Self assembling nanostructure molecular materials and devices: Building block, Principles of self assembly, Methods to prepare and pattern nanoparticles, Templated nanostructures, Liquid crystal mesophases. Nanomagnetic materials and devices: Magnetism, materials, Magneto resistance, Nanomagnetism in technology, Challenges facing into nanomagnetism.

Applications: Injection Lasers: Quantum cascade lasers, Single photon sources. Biological tagging, Optical memories, Coulomb blockade devices, Photonic structures, QWIP's, NEMS, and MEMS.

Reference books:

1. Ed Robrt Kelsall, Ian Hamley, and Mark Geoghegan, **"Nanoscale Science and Technology"**, John Wiley and Sons, 2007.

2. Charles P. Poole, Jr. Frank J. Owens, **"Introduction to Nanotechnology"** John Wiley, 2006, reprint-2011.

3. Ed William, A. Goddard III, Donald W. Brenner, Sergey Edward, Lyshevski, and Gerald J. Lafrate, **"Handbook of Nanoscience Engineering and Technology"**, CRC press, 2003.

CMOS VLSI Design

Subject Code	**: 14ECS154**	**IA Marks**	**: 50**
No.of Lecture Hours Week	**: 04**	**Exam. Hours**	**: 03**
Total No.of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

MOS transistor theory: NMOS/PMOS transistor, Threshold voltage equation, Body effect, MOS device design equation, Sub threshold region, Chanel length modulation, Mobility variations, tunnelling, Punch through, Hot electron effect MOS models, Small signal AC characteristic, CMOS inverters, An/Ap ratio, noise margin, Static load MOS inverters, Differential inverter, Transmission gate, Tristate inverter, BiCMOS inverter.

CMOS process Technology: Lambda based design rules, Scaling factor, Semiconductor technology overview, Basic CMOS technology, p-well/ n-well/ twin-well process. Current CMOS enhancement (oxide isolation, LDD, refractory gate, Multilayer interconnect), Circuit element, resistor, Capacitor, Interconnects, Sheet resistance and standard unit capacitance concept delay unit time, Inverter delays driving capacitive loads, Propagate delays, MOS mask layer, Stick diagram, design rules and layout, Symbolic diagrams, MOS feints, Scaling of MOS circuits..

Basic of Digital CMOS design: Combinational MOS logic circuits -Introduction, CMOS logic circuits with the a MOS load, CMOS logic circuits, Complex logic circuits, transmission gate, Sequential MOS logic circuits - Introduction, Behaviour of high stable elements, SR latch circuits, Clocked latch and flip-flop circuits, CMOS D-latch and triggered flip-flop, Dynamic logic circuits - Introduction, principles of pass transistor circuits, Voltage bootstrapping synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques.

CMOS analog design: Introduction, Single amplifier, Differential amplifier, Current mirrors, Bandgap references, Basis of cross operational amplifier.

Dynamic CMOS and clocking: Introduction, Advantages of CMOS over NMOS, CMOS/SOS technology, CMOS/bulk technology, Latchup in bulk CMOS, Static CMOS design, Domino CMOS structure and design, Charge sharing, Clocking - Clock generation, Clock distribution, Clocked storage elements.

Reference books:

- Neil Weste and K. Eshraghian, **"Principles of CMOS VLSI design: A system perspective"**, Pearson education (Asia) Pvt. Ltd. 2nd edition, 2000.
- Wayne Wolf, **"Modern VLSI design: System on Silicon",** Pearson education, 2nd edition.
- Douglas A. Pucknell and Kamram Eshraghian, **"Basic VLSI design",** PHI, 3rd edition, (original edition - 1994).
- Sung Mo Kang and Yosuf Lederabic Law, **"CMOS digital integrated circuits: Analysis and design"**, McGraw Hill, 3rd edition.

Simulation, Modelling, and Analysis

Subject Code	**: 14ELD155**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Basic simulation modeling: Nature of simulation, System models, discrete event simulation, Single server simulation, Alternative approaches, Other types of simulation.

Building valid, credible and detailed simulation models: Techniques for increasing model validity and credibility, comparing real world observations.
Selecting input probability distributions: Useful probability distributions, Assessing sample independence, Activity-I, II and III, Model of arrival process.

Random number generators: Linear congruential, Other kinds, Testing number generators, Random variate generation: Approaches, Continuous random variates, Discrete random variates, Correlated random variates.

Output data analysis: Statistical analysis for terminating simulation, Analysis for steady state parameters, Comparing alternative system configuration, Confidence interval, Variance reduction techniques, Arithmetic and control variates.

Reference books:

1. Averill Law, **"Simulation modeling and analysis"**, McGraw Hill 4th edition, 2007.
2. Jerry Banks, **"Discrete event system Simulation"**, Pearson, 2009.
3. Seila Ceric and Tadikamalla, **"Applied simulation modeling"**, Cengage, 2009.
4. George. S. Fishman, **"Discrete event simulation"**, Springer, 2001.
5. Frank L. Severance, **"System modeling and simulation"**, Wiley, 2009.

DEC Lab – 1

Subject Code	**: 14ECS16**	**IA Marks**	**: 50**
No. of Lecture Hours Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Experiments can be done using Hardware tools such as Spectrum analyzers, Signal sources, Power Supplies, Oscilloscopes, High frequency signal sources, fiber kits, Measurement benches, DSP processor kit, FPGA kit, Logic analyzers, PC setups, etc. Software tools based experiments can be done using, FEKO simulator, NS2 simulator, MATLAB, etc.

1. Matlab/C implementation of to obtain the radiation pattern of an antenna.
2. Experimental study of radiation pattern of different antennas.
3. Significance of pocklington's integral equation.
4. Measurement techniques of radiation characteristics of an antenna.
5. Impedance measurements of Horn/Yagi/dipole/Parabolic antennas.
6. Analysis of E & H plane horns.
7. Determine the directivity and gains of Horn/ Yagi/ dipole/ Parabolic antennas.
8. Determination of the modes transit time, electronic timing range and sensitivity of klystron source.
9. Antenna resonance and gain bandwidth measurements.
10. Study of digital modulation techniques using CD4051 IC
11. Build a hardware pseudo-random signal source and determine statistics of the generated signal source..
12. Conduct an experiment for Voice and data multiplexing using optical fiber.
13. Determination of VI characteristics of GUNN diode, and measurement of guide wave length, frequency, and VSWR.
14. Determination of coupling coefficient and insertion loss of directional couplers and Magic tree.
15. Determine the frequency response of BPSK, BFSK, and Binary ASK modulators using Spectrum analyzers.

Semester - II

Wireless Communication

Subject Code	**: 14ECS21**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Wireless channel: Physical modeling for wireless channels, I/O model of wireless channels, time and frequency response, Statistical models

Point-to-Point Communication: Detection in Rayleigh fading channels, Time diversity, Antenna diversity, Frequency diversity, Impact of the channel uncertainty.

Diversity: Introduction Micro-diversity, Micro-diversity and Simulcast combination of signals, Error probability in fading channels with diversity reception, Transmit diversity.

Capacity of wireless channel: AWGN channel capacity, Resources of AWGN channel, Linear time invariant Gaussian channel, Capacity of fading channels.

MIMO Systems: Introduction, Space diversity and system based on space diversity, Smart antenna systems and MIMO, MIMO based system architecture; MIMO exploits multipath, Space time processing, Antenna considerations for MIMO. MIMO channel modeling, MIMO channel measurements, MIMO channel capacity, CDD, Space time coding, advantages and applications of MIMO, MIMO application in 3G,

MIMO-1, Spatial multiplexing channel modeling: Multiplexing capability of MIMO channels, Physical modeling of MIMO channels. Modeling MIMO fading channels, Multi antenna systems, Smart antennas, Multiple Input and Multiple Output systems.

Reference books:

1. David Tse, P. Vishwanath, **"Fundamentals of Wireless Communication",** Cambridge, 2006.
2. Ke-Lin Du, ad M.N.S. Swamy, **"Wireless communication systems-From RF subsystems to 4G enabling Technologies",** Cambridge, South Asian 2010 edition.
3. C. Y. William, Lee, **"Mobile communication engineering theory and applications",** TMH, 2008.
4. Upen Dalal, **"Wireless communication",** Oxford, 2009.
5. Mark Ciampa, Jorge Olenwa, **"Wireless communication",** Cengage, 2007.

RF and Microwave Circuit Design

Subject Code	**: 14ECS22**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Wave propagation in network: Introduction, Reasons for using RF/Microwaves, Applications', RF waves, RF and Microwave circuit design, Introduction to components basics, Analysis of simple circuit phasor domain, RF impedance matching, Properties of waves, transmission media, Micro strip lines, High frequency parameters, Formulation of S-parameters, Properties, transmission matrix, Generalized S-parameters.

Passive circuit design: Introduction, Smith chart, Scales, Application of Smith chart, Design of matching networks, Definition of impedance matching, Matching using lumped and distributed elements.

Basic consideration in active networks and design of amplifiers, oscillators and detector: Stability consideration, gain consideration, Noise consideration. Linear and nonlinear design: Introduction, Types of amplifier, Design of different types of amplifiers, Multistage small signal amplifiers, Design of transistor oscillators, Detector losses, detector design.

Mixers Phase shifters and RF and Microwave IC design: Mixer types, Conversion loss for SSB mixers, One diode mixer, Phase shifters, Digital phase shifters, Semiconductor phase shifters, RF and microwave IC design, MICs, MIC materials, Types of MICs, Hybrid verses monolithic ICs, Chip materials.

Reference books:

1. Matthew M. Radmanesh, **"RF and Microwave Electronics Illustrated",** Pearson Education edition, 2004.
2. Reinhold Ludwig, and Pavel Bretchko,**"RF circuit design theory and applications",** Pearson Education edition, 2004

.Modern DSP

Subject Code	**: 14ECS23**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction and Discrete Fourier transforms: Signals, Systems and processing, Classification of signals, The concept of frequency in continuous time and discrete time signals, Analog to digital and digital to analog conversion, Frequency-domain sampling. The discrete Fourier transform, Properties of the DFT, Linear filtering methods based on the DFT.

Design of digital filters: General considerations, design of FIR filters, Design of IIR filters from analog filters, Frequency transformations.

Multirate digital signal processing: Introduction, decimation by a factor 'D', Interpolation by a factor 'I', sampling rate conversion by a factor 'I/D', Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of band pass signals, Sampling rate conversion by an arbitrary factor, Applications of multirate signal processing, Digital filter banks, two channel quadrature mirror filter banks, M-channel QMF bank.

Adaptive filter: Applications of adaptive filters, Adaptive direct form FIR filters, The LMS algorithm, Adaptive direct form filters, RLS algorithm.

Reference books:

1. Proakis, and Manolakis, "Digital signal processing", 3rd edition, Prentice Hall, 1996.

2. Robert. O. Cristi, "Modern Digital signal processing", Cengage Publishers, India, 2003.

3. S. K. Mitra, "Digital signal processing: A computer based approach", 3rd edition, TMH, India, 2007.

4. E.C. Ifeachor, and B. W. Jarvis, "Digital signal processing: A Practitioner's approach", Second Edition, Pearson Education, India, 2002, Reprint

Optical Communication and Networking

Subject Code	**: 14ECS24**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction: Propagation of signals in optical fiber, Different losses, Nonlinear effects, Solutions, Optical sources, Detectors.

Optical components: Couplers, Isolators, Circulators, Multiplexers, Filters, Gratings, Interferometers, Amplifiers.

Modulation - Demodulation: Formats, Ideal receivers, Practical detection receivers, Optical preamplifiers, Noise considerations, Bit error rates, Coherent detection.

Transmission system engineering: System model, Power penalty, Transmitter, Receiver, Different optical amplifiers, Dispersion.

Optical Networks: Client layers of optical layer, SONET/SDH, Multiplexing, layers, Frame structure, ATM functions, Adaptation layers, Quality of Service (QoS) and flow control, ESCON, HIPPL.

WDM network elements: Optical line terminal, Optical line amplifiers, Optical cross connectors, WDM network design, Cost trade offs, LTD and RWA problems, Routing and wavelength assignment, Wavelength conversion, Statistical dimensioning model.

Control and management: Network management functions, management framework, Information model, management protocols, Layers within optical layer performance and fault management, Impact of transparency, BER measurement, Optical trace, Alarm management, Configuration management.

Reference books:

1 John M. Senior, **"Optical fiber communication",** Pearson edition, 2000.

2 Rajiv Ramswami and K. N. Sivarajan, **"Optical Networks",** Morgon Kauffman Publishers, 2000.

3 Gerd Kaiser, **"Optical fiber Communication Systems",** John Wiley, New York, 1997.

4 P. E. Green, **"Optical Networks",** Prentice Hall, 1994.

Broadband Wireless Networks

Subject Code	**: 14ECS251**	**IA Marks**	**: 50**
No.of.Lecture.Hours/Week	**: 04**	**Exam. Hours**	**: 03**
Total.No.of.Lecture.Hours	**: 50**	**Exam.Marks**	**: 100**

WiMAX Genesis and framework: 802.16 standard, WiMAX forum, Other 802.16 standards, Protocol layer topologies - Layers of WiMAX, CS, MAC CPS, Security layer, Phy layer, Reference model, topology.

Frequency utilization and system profiles: Cellular concept, Licensed and unlicensed frequencies, Fixed WiMAX system profiles, Mobile WiMAX profiles.

WiMAX physical layer: OFDM transmission, SOFDMA, subcarrier permutation, 802.16 transmission chains, Channel coding, Turbo coding, Burst profile.

WiMAX MAC and QoS: CS layer, MAC function and frames, Multiple access and burst profile, Uplink bandwidth allocation and request mechanisms, Network entry and QoS management.

Radio engineering considerations: Radio resource management, Advance antenna technology in WiMAX, MBS. WiMAX architecture, Mobility handover and power save modes, Security.

Reference books:

1. Loutfi Nuyami, **"WiMAX - Technology for broadband access"**, John Wiley, 2007.

2. Yan Zhang, Hsia-Hwa Chen, **"Mobile WiMAX"**, Aurobech Publications, 2008.

ASIC Design

Subject Code	**: 14ECS252**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction: Full custom with ASICs, Semicustom ASICs, Standard cell based ASIC, Gate array based ASIC, Channelled gate array, Channel less gate array, structured gate array, Programmable logic device, FPGA design flow, ASIC cell libraries.
Data logic cells: Datapath elements: Adders, Multipliers, Arithmetic operator, I/O cell, Cell compilers.

ASIC Library design: Logical effort: Practicing delay, Logical area and logical efficiency, Logical paths, Multi stage cells, optimum delay, Optimum number of stages, Library cell design.

Low-level design entry: Schematic entry: Hierarchical design, The cell library, Names, Schematic, Icons and symbols, Nets, Schematic entry for ASICs, Connections, Vectored instances and buses, Edit in place attributes, Netlist, Screener, back annotation.

Programmable ASIC: Programmable ASIC logic cell, ASIC I/O cell.
A brief introduction to low level design Language: An Introduction to EDIF, PLA tools, An introduction to CFI designs representation, Half gate ASIC, Introduction to synthesis and simulation.

ASIC construction, floor planning and placement and routing: Physical design, CAD tools, System partitioning, Estimating ASIC size, Partitioning methods, Floor planning tools, I/O and power planning, Clocking planning, Placement algorithms, Iterative placement improvement, Ti driven placement methods, Physical design flow global routing, Logical routing, Detailed routing, Special routing, Circuit extraction and DRC.

Reference books:

1. M. J. S. Smith, "Application Specific Integrated Circuits", Pearson education, 200.
2. Jose E. France, Yannis Tsividis, "Design of Analog Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.
3. Malcolm R. Haskard, and Lan. C. May, "Analog VLSI design - NMOS and CMOS", Prentice Hall, 1998.
4. Mohammad Ismail and Terri Fiez, "Analog VLSI signal and Information Processing", McGraw Hill, 1994.

Advanced Embedded System

Subject Code	**: 14ECS253**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Typical embedded system: Core of the embedded system, Memory, Sensors and Actuators, Commutation interface, Embedded firmware, Other system components. Characteristics and quality attribution of Embedded Systems.

Hardware software co-design and program modelling: Fundamental issues in hardware software co-design, Computational models in embedded design, Introduction to Unified modelling language, Hardware software trade-off.

Embedded firmware design and development: Embedded firmware design approaches, Embedded firmware development language.

Real time operating system (RTOS) based embedded system design: Operating system basics, Types of OS, Tasks, Process and threads, Multiprocessing and multitasking, Task scheduling, Threads, Processing and scheduling: Putting them altogether, Task communication, task synchronization, Device drivers, How to choose an RTOS.

The embedded system development environment: The Integrated development environment (IDE), Types of files generated on cross compilation, Disassembler/Decompilers, Emulators and debugging, Target hardware debugging, Boundary scan.

Trends in the embedded industry: Processor trends in embedded system, Embedded OS trends, development language trends, Open standards, Frameworks and alliances, Bottlenecks.

Reference books:

1. K. V. Shibu, **"Introduction to embedded systems",** TMH education Pvt. Ltd. 2009.

2. James K. Peckol, **"Embedded systems- A contemporary design tool",** John Wiley, 2008

Multimedia communication

Subject Code	**: 14ECS254**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Multimedia Communications: multimedia information representation, multimedia networks, multimedia applications, network QoS and application QoS. (Ref.1 Chap. 1)

Information Representation: text, images, audio and video, Text and image compression, compression principles, text compression, image compression. Audio and video compression, audio compression, video compression, video compression principles, video compression standards: H.261, H.263, P1.323, MPEG 1, MPEG 2, Other coding formats for text, speech, image and video.(Ref 1 Chap 3 &4)

Detailed Study of MPEG 4: coding of audiovisual objects, MPEG 4 systems, MPEG 4 audio and video, profiles and levels. MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework, Significant features of JPEG 2000, MPEG 4 transport across the Internet. (Ref2. Chap.5)

Synchronization: Notion of synchronization, presentation requirements, reference model for synchronization, Synchronization specification.

Multimedia operating systems, Resource management, process management techniques. (Ref. 3. Cahp 9 & 11)

Multimedia Communication Across Networks: Layered video coding, error resilient video coding techniques, multimedia transport across IP networks and relevant protocols such as RSVP, RTP, RTCP, DVMRP, multimedia in mobile networks, multimedia in broadcast networks. (Ref.2 Chap. 6)

Assignments / Practicals can be given on writing the programs to encode and decode the various kinds of data by using the algorithms. Students can collect several papers from journals/conferences/Internet on a specific area of multimedia communications and write a review paper and make a presentation

Reference Books:

1. Fred Halsall, "**Multimedia Communications**", Pearson education, 2001

2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "**Multimedia Communication Systems**", Pearson education, 2004

3. Raif steinmetz, Klara Nahrstedt, "**Multimedia: Computing, Communications and Applications**", Pearson education, 2002

4. John Billamil, Louis Molina, "**Multimedia : An Introduction**", PHI, 2002

Spread Spectrum Communication

Subject Code	**: 14ECS255**	**IA Marks**	**: 50**
No. of Lecture Hours /week	**: 04**	**Exam Hours**	**: 03**
Total no. of Lecture Hours	**: 50**	**Exam Marks**	**: 100**

Review of digital communication concepts, direct sequence and frequency hop spread spectrum systems.

Hybrid direct sequence/frequency hop spread spectrum. Complex envelop representation of spread spectrum signals.

Sequence generator fundamentals, Maximum length sequences. Gold and Kasami codes, Nonlinear Code generators.

Spread spectrum communication system model, Performance of spread spectrum signals in jamming environments, Performance of spread spectrum communication systems with and without forward error correction.

Diversity reception in fading channels, Cellular radio concept, CDMA cellular systems. Examples of CDMA cellular systems. Multicarrier CDMA systems. CDMA standards

Reference Books:

1. R. L. Peterson, R. E. Zeimer and D. E. Borth, **"Introduction to Spread Spectrum Communications"**, Pearson, 1995.

2. J. D. Proakis and M. Salehi, **"Digital Communication"**, McGraw Hill, 2008

3. J. Viterbi, **"CDMA: Principles of Spread Spectrum Communications"**, Addision Wesley, 1995.

4. S. Verdu, **"Multiuser Detection"**, Cambridge University Press, 1998

DEC Lab – 2

Subject Code	**: 14ECS26**	**IA Marks**	**: 25**
No. of Lecture Hours / Week	**: 03**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 42**	**Exam. Marks**	**: 50**

List of laboratory Experiments - Modern digital signal processing using MATLAB

1. Question based on response of LTI systems to diffrent inputs. A LTI system is defined by the difference equation y[n]=x[n]+x[n+1]+x[n+2].
   (a) determine the impulse response of the system and sketch it.
   (b) determine the output y[n] of the system when the input is x[n]=u[n].
   (c) Determine the output of the system when the input is a complex exponential (E.g. x[n]=2*exp(j0.26n)).

2. Question on design of simple digital filter using the relationship between pole and zeros and the frequency response of the system.
   Design a simple digital FIR filter with real coefficient to remove a narrowband i.e., sinusoidal) disturbance with frequency fo=50Hz. Let fs=300Hz be the sampling frequency.
   (a) Determine the desired zeros and poles of the filter.
   (b) Determine the filter coefficients with the gain K=1.
   (c) Sketch the magnitude of the frequency response.

3. Question on simple digital filtering using the relationship between pole and zeros and the frequency response of the system.
   Design an IIR filter with real coefficient with same specifications mentioned in Q2 and repeat the steps (a) to (c).

4. . Question to understand the effect of time domain windowing
   Generate a signal with two frequencies x(t)=3 Cos(2Pi f1*t)+2 Cos(2Pi f2*t)sampled at fs=8kHz. Let f1=1kHz and f2=f1+'A" and the overall data length be N=256points.
   (a) From theory, determine the minimum value of 'A' necessary to distinguish between the two frequencies.
   (b) Verify this result experimentally, Using the rectangular window, look at the DFT with several values of 'A' so that you verify the resolution.

   (c) repeat part (b0 using a hamming window. How did the resolution change?

5. Comparison of DFT and DCT (in terms of energy compactness)
   Generate the sequence x[n]=n-64 for n=0, ...127.
   (a) Let X[k] = DFT{x[n]}. For various values of l, set to zero "high frequency coefficients" X[64-l]= ....X[64]= .....X[64+L]=0 and take the inverse DFT. Plot the results.
   (b) Let XDCT[k]=DCT(X[n]). For the same values of L, set to zero "high frequency coefficient" XDCT [127-L]= ....XDCT[127]. Take the inverse DCT for each case and compare the reconstruction with the previous case.

6. Filter design:
   design a discrete low pass filter with the specification given below:
   Sampling frequency =2kHz
   Passband edge = 260Hz.
   Stop band edge = 340Hz
   Max. pass band attenuation=0.1dB.
   minimum stop band attenuation = 30dB.
   Use the following design methodologies:
   Hamming windowing
   Kaiser windowing,
   Applying bilinear transformation to a suitable Butterworth filter. Compare the obtained filters in terms of performance (accuracy in meeting specifications) and computational complexity).

List of experiments to be done using the DSP processor

1. Write an ALP to obtain the response of a system using linear convolution whose input and impulse response are specified.

2. . Write an ALP to obtain the impulse response of the given system, given the difference equation.

3. . Sampling of an Image.

4. Design of equiripple filters.

5. Applications of frequency transformation in filter design.

6. . Computation of FFT when N is not a power of 2.

7. . Sampling rate conversion and plot of spectrum

8. Analysis of signals by STFT and WT

9. . Delayed auditory feedback signal using 6713 processor.

10. Record of machinery noise like fan or blower or diesel generator and obtaining its spectrum.

11. Synthesis of select dual tone multi frequency using 6713 processor.

12. Fourier Transform and its inverse Fourier transform of an Image.

SEMESTER - IV

Error control coding

Subject Code	**: 14ECS41**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction to algebra: Groups, FiECSs, binary fiECS arithmetic, Construction of Galois FiECS GF (2m) and its properties, Computation using Galois filed GF (2m) arithmetic, Vector spaces and Matrices.

Linear block codes: Generator and parity check matrices, Encoding circuits, Syndrome and error detection, Minimum distance considerations, Error detecting and error correcting capabilities, Standard array and syndrome decoding, decoding circuits, Hamming codes, Reed-Muller codes. Golay codes, Product codes and interleaved codes.

Cyclic codes: Introduction, Generator and parity check polynomials, Encoding using multiplication circuits, Systematic cyclic codes - Encoding using feedback shift register circuits, generator matrix for cyclic code, Syndrome computing and error detection, Meggitt decoder, Error trapping decoding, Cyclic hamming codes, Golay code, Shortened cyclic codes.

BCH codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois fiECS arithmetic, Implementation of error correction. Non-binary BCH codes: q-ary linear block codes, Primitive BCH codes over GF(q), Reed -Solomon codes, decoding of non-binary BCH and RS codes: The Berlekamp - Massey Algorithm.

Majority Logic decodable codes: One -step majority logic decoding, One-step majority logic decodable codes, Two-step majority logic decoding, Multiple-step majority logic decoding.

Convolution codes: Encoding of convolutional codes, Structural properties, Distance properties, Viterbi decoding algorithm for decoding, Soft output Viterbi algorithm, Stack and Fano sequential decoding algorithms, Majority logic decoding.

Concatenated codes and Turbo codes: Single level concatenated codes, Multilevel concatenated codes, Soft decision multistage decoding, Concatenated coding schemes with convolutional inner codes, Introduction to Turbo coding and their distance properties, design of Turbo codes.

Burst - error - Correcting codes: Burst and random error correcting codes,

Concept of interleaving, Cyclic codes for burst error correction - Fire codes, Convolutional codes for burst error correction

Reference books:

1. Shu Lin and Daniel J. Costello. Jr, "Error control coding", Pearson, Prentice Hall, 2nd edition, 2004.
2. Blahut. R. E, "Theory and practice of error control codes", Addison Wesley, 1984.

RF MEMS

Subject Code	**: 14ECS421**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Review: Introduction to MEMS: Fabrication for MEMS transducers and actuators, Microsensing for MEMS, Materials for MEMS.

MEMES materials and fabrication techniques: Metals, Semiconductors, Thin films, Material s for polymer MEMS, Bulk machining for Silicon based MEMS, Surface machining for Silicon based MEMS, Micro stereo-lithography for polymer MEMS.

RF MEMS Switches and micro-relays: Switch parameters, Basics of switching, Switches for RF and Microwave applications, Actuation mechanisms, Micro-relays and micro-actuators, Dynamic of switch operations, MEMS switch design and design consideration, MEMS inductors and capacitors.

Micro machined RF filters and phase shifters: RF filters, Modelling of mechanical filters, Micro-mechanical filters, SAW filters - Basic, Design consideration. Bulk acoustic wave filters, Micro-machined filters for millimetre wave frequencies. Micro-machined phase shifters, Types and limitations, MEMS and Ferroelectric phase shifters, Application.

Micromachined transmission line and components: Micromachined transmission line: Losses in transmission line, coplanar lines, MicroshiECS and membrane supported lines, MicroshiECS components, Micromachined waveguides, Directional couplers and Mixers, Resonators and Filters.

Micromachined antennas: design, Fabrication and measurements, Integration and packaging for RF MEMS, Roles and types of packages, Flipchip techniques, Multichip module packaging and Wafer bonding, Reliability issues and thermal issues.

Reference books:

1. V. K. Varadan, A. Laktakia, and K. J. Vinoy, **"RF MEMS",** John Wiley, 2003 reprint.
2. J De Los Santos, **"RF MEMS circuit design",** Artech House, 2002.
3. Frank Ghenassia, **"Transaction Level Modelling with System C: TLM concepts and applications for Embedded Systems"**, Springer, 2005.
4. Luca Beninid, **"Networks on chips: Technology and Tools",** Morgan Kaufmann Publishers, 2006.

Advanced Computer Networks

Subject Code	**: 14ECS422**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction: Computer network, Telephone networks, Networking principles. Multiple access: Multiplexing - FDM, TDM, SM.

Local Area networks: Ethernet, Token ring, FDDI, Switching - Circuit switching, Packet switching, Multicasting.

Scheduling: Performance bounds, Best effort disciplines, Naming and addressing, Protocol stack, SONET, SDH.

ATM Networks: AAL, Virtual circuits, SSCOP, Internet - Addressing, Routing, Endpoint control.

Internet Protocol: IP, TCP, UDP, ICMP, HTTP.

Traffic management: Models, Classes, Scheduling.

Control of Networks: QoS, Static and dynamic routing, Markov chains, Queuing models, Bellman Ford and Dijkstra's algorithm, Window and rate congestion control, Large deviations of a queue and network, Open and closed loop flow control, Control of ATM networks.

Reference books:

1. J. Walrand and P. Varaya, **"High performance communication networks",** Harcourt Asia (Morgan Kaufmann), 2000.

2. S. Keshav, **"An Engineering approach to Computer Networking",** Pearson Education, 1997.

3. Leon-Garcia, and I. Widjaja, **"Communication network: Fundamental concepts and key architectures",** TMH, 2000.

4. J. F. Kurose, and K. W. Ross, **"Computer networking: A top down approach featuring the Internet",** Pearson Education, 2001.

Advances in VLSI Design

Subject Code	**: 14ECS423**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Review of MOS circuits: MOS and CMOS static plots, Switches, Comparison between CMOS and BiCMOS.

MESFETs: MESFET and MODFET operations, Quantitative description of MESFETs.

MIS structure and MOSFETS: MIS systems in equilibrium, Under bias, Small signal operation of MESFETs and MOSFETs.

Short channel effects and challenges to CMOS: Short channel effects, Scaling theory, Processing challenges to further CMOS miniaturization.

Beyond CMOS: Evolutionary advances beyond CMOS, Carbon nano-tubes, Conventional v/s tactile computing, Computing, Molecular and biological computing **Mole-electronics** - Molecular Diode and diode-diode logic. Defect tolerant computing.

Super Buffers, BiCMOS and Steering Logic: Introduction, RC delay lines, Super buffers- An NMOS super buffer, tristate super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, Large capacitive loads, Pass logic, Designing of transistor logic, General functional blocks - NMOS and CMOS functional blocks.

Special Circuit Layout and Technology mapping: Introduction, Talley circuits, NAND-NAND, NOR-NOR, AOI logic, NMOS, CMOS multiplexers, Barrel shifters, Wire routing and module layout.

System design: CMOS design methods, Structured design methods, Strategies encompassing hierarchy, Regularity, Modularity and Locality, CMOS chip design options, Programmable logic, Programmable inter connect, Programmable structure, Gate arrays, Standard cell approach, Full custom design.

Reference books:

1. Kevin F. Burman, Introduction to Semiconductor device", Cambridge publications.

2. Eugen D. Fabricius, "Introduction to VLSI design" McGraw Hill International publications.

3. D. A. Pucknell, "Basic VLSI Design", PHI publication.

4. Wayne Wolf, "Modern VLSI design", Pearson education, 2nd edition, 2002.

Communication System design using DSP algorithm

Subject Code	**: 14ECS424**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction to the course: Digital filters, Discrete time convolution and frequency responses, FIR filters - Using circular buffers to implement FIR filters in C and using DSP hardware, Interfacing C and assembly functions, Linear assembly code and the assembly optimizer. IIR filters - realization and implementation, FFT and power spectrum estimation: DTFT window function, DFT and IDFT, FFT, Using FFT to implement power spectrum.

Analog modulation scheme: Amplitude Modulation - Theory, generation and demodulation of AM, Spectrum of AM signal. Envelope detection and square law detection. Hilbert transform and complex envelope, DSP implementation of amplitude modulation and demodulation.

DSBSC: Theory generation of DSBSC, Demodulation, and demodulation using coherent detection and Costas loop. Implementation of DSBSC using DSP hardware.

SSB: Theory, SSB modulators, Coherent demodulator, Frequency translation, Implementation using DSP hardware.

Frequency modulation: Theory, Single tone FM, Narrow band FM, FM bandwidth, FM demodulation, Discrimination and PLL methods, Implementation using DSP hardware.

Digital Modulation scheme: PRBS, and data scramblers: Generation of PRBS, Self synchronizing data scramblers, Implementation of PRBS and data scramblers. RS-232C protocol and BER tester: The protocol, error rate for binary signalling on the Gaussian noise channels, Three bit error rate tester and implementation.

PAM and QAM: PAM theory, baseband pulse shaping and ISI, Implementation of transmit filter and interpolation filter bank. Simulation and theoretical exercises for PAM, Hardware exercises for PAM.

QAM fundamentals: Basic QAM transmitter, 2 constellation examples, QAM structures using passband shaping filters, Ideal QAM demodulation, QAM experiment. QAM receivers-Clock recovery and other frontend sub-systems. Equalizers and carrier recovery systems. Experiment for QAM

receiver frontend. Adaptive equalizer, Phase splitting, Fractionally spaced equalizer. Decision directed carrier tracking, Blind equalization, Complex cross coupled equalizer and carrier tracking experiment.

Echo cancellation for full duplex modems: Multicarrier modulation, ADSL architecture, Components of simplified ADSL transmitter, A simplified ADSL receiver, Implementing simple ADSL Transmitter and Receiver.

Reference Books:

1. Robert. O. Cristi, **"Modern Digital signal processing",** Cengage Publishers, India, 2003.
2. S. K. Mitra, **"Digital signal processing: A computer based approach",** 3rd edition, TMH, India, 2007.
3. E.C. Ifeachor, and B. W. Jarvis,**"Digital signal processing: A Practitioner's approach",** Second Edition, Pearson Education, India, 2002,
4. .Proakis, and Manolakis, **"Digital signal processing"**, 3rd edition, Prentice Hall, 1996.

Advanced Radar Systems

Subject Code	**: 14ECS425**	**IA Marks**	**: 50**
No. of Lecture Hours / Week	**: 04**	**Exam. Hours**	**: 03**
Total No. of Lecture Hours	**: 50**	**Exam.Marks**	**: 100**

Introduction: Range equation, Transmitter and Receiver parameters, and Model, Types of Radars.

Radar Signal transmission: Transmitted waveforms (time and frequency domains), Energy, Radar signal analysis using autocorrelation and Hilbert transform, Pulse compression, Clutter: Properties, reduction, coding and chirp.

Radar antenna: Reflector types, Sidelobe control, Arrays - Array factor and beamwidth, Synthetic aperture, adaptive antennas.

Propagation effects: Multipath, Low altitude, Ionosphere.

Radar Networks: Matched filter response and noise consideration.

Data Processing: FFT, Digital MTI, Tracking, Plot track.

Applications: Secondary surveillance, Multistatic, Over the Horizon, Remote sensing and Meteorological radars.

Reference Book:

1 Meril I. Skolnik, **"Radar handbook"**.

2. M. J. B. Scanlan, **"Modern Radar Techniques"**.

3. Peyton Z. Peebles, **"Radar principles",** Wiley Interscience.