M.E. (Part Time /Full Time) **Prospectus No. 151739**

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

अभ्यासक्रमिका

(FACULTY OF ENGINEERING & TECHNOLOGY)

PROSPECTUS

Prescribed for
Post Graduate Degree Course
Master of Engineering
(Part Time / Full Time)

I & IInd Year Examinations 2014 - 2015 & Onwards
Semester Pattern
Credit Grade System

BRANCH

1) M.E. (Digital Electronics(Part Time/Full Time)
2) M.E. (Electronics & Telecommunications (Full Time)

2015

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Published by :
Dineshkumar Joshi
Registrar,
Sant Gadge Baba Amravati University
Amravati - 444 602

SANT GADGE BABA AMRAVATI UNIVERSITY

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	:	Enrolment of Students.
Ordinance No. 2	:	Admission of Students
Ordinance No. 4	:	National cadet corps
Ordinance No. 6	:	Examinations in General (relevent extracts)
Ordinance No. 18/2001	:	An Ordinance to provide grace marks for passing in a Head of passing and Inprovement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001.
Ordinance No. 9	:	Conduct of Examinations (relevent extracts)
Ordinance No. 10	:	Providing for Exemptions and Compartments
Ordinance No. 19	:	Admission of Candidates to Degrees.

Ordinance No. 109	:	Recording of a change of name of a University student in the records of the University.
Ordinance No. 6 of 2008	:	For improvement of Division/Grade.
Ordinance No.19/2001	:	An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dineshkumar Joshi
Registrar
Sant Gadge Baba Amravati University

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The pattern of question paper as per unit system will be broadly based on the following pattern.

(1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.

(2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.

(3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.

(4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.

(5) Each short answer type question shall Contain 4 to 8 short sub question with no internal choice.

SANT GADGE BABA AMRAVATI UNIVERSITY
DIRECTION

No. 31/2010 Date : 24 /6/2010

Subject : Examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full-Time) / तंत्रशास्त्र पारंगत (Master of Technology) (Full Time) (Semester Pattern .... Credit Grade System)

Whereas the schemes of teaching & examinations of Master of Engineering (Full-Time) / Master of Technology (Full Time) courses has been accepted by the Academic Council vide Item No. 49 in its meeting held on 28-05-2010 as per the Credit Grade System for its implementation from the Academic Session 2010-2011,

AND

Whereas admissions to the First Year of Master of Engineering (Fullt-Time) / Master of Technology (Full Time) courses are to be made in the Academic Session 2010-2011,

AND

Whereas the matter for admission of the students at the examinations is required to be regulated by an Ordinance,

AND

Whereas the schemes of teaching & examinations of I and II Semesters of Master of Engineering (Full-Time) / Master of Technology (Full Time) courses are to be implemented from the academic session 2010-2011,

AND

Whereas the schemes of teaching & examinations are required to be regulated by the Regulation,

AND

Whereas the process of making an Ordinance and the Regulation is likely to take some time,

AND

Whereas syllabus for I and II Semesters of Master of Engineering (Full-Time) / Master of Technology (Full Time) courses are to be sent for printing.

Now, therefore, I, Dr.Ku.Kamal Singh, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers confirmed upon me under sub section (8) of Section 14 of the

Maharashtra Universities Act, 1994, hereby direct as under :

1. This Direction may be called “Examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full-Time) / तंत्रशास्त्र पारंगत (Master of Technology) (Full Time) (Semester Pattern .... Credit Grade System) Direction, 2010.
2. This Direction shall come into force w.e.f. the session :-
   i) 2010-2011 for First Year, and
   ii) 2011-2012 for Second Year
3. Following shall be the Examinations leading to the Degree of Master of Engineering (Full Time)/ Master of Technology (Full Time) courses :-
   i) M.E./M.Tech. Semester-I Examination
   ii) M.E./M.Tech. Semester-II Examination
   iii) M.E./M.Tech. Semester-III Examination
   iv) M.E./M.Tech. Semester-IV Examination
3.
4. Examinations of IIIrd & IVth semesters shall be held at the end of IVth semester seperately.
5. An applicant for admission to the Degree of Master of Engineering (Full Time) / Master of Technology(Full-Time) courses shall have passed the Degree Examination in Bachelor of Engineering/Bachelor of Technology in the branches mentioned under column No.2 of the following table against respective course :-

TABLE

M.E./M.Tech.	B.E./B.Tech. of this University or any other statutory University
1.	2.
a) M.E. Civil (Structural Engg.)	Civil /Construction Engg., Water Management
b) M.E. Mechanical (CAD/CAM)	Mechanical/Automobile/Production/ Industrial Engineering
c) M.E. Digital Electronics	Electronics & Telecommunication, Electronics Engg., Industrial Electronics, Instrumentation & Information Tech.
d) M.E. Electrical (E.P.S.)	Electrical / Electrical Power System / Electronics & Power
e) M.Tech. Chemical Technology (Membrane & Separation Technology)	Chemical Engineering/Chemical Technology

f) M.Tech. (Chemical Engineering)	Chemical Engg./Chemical Tech., Petrochemical Engg./Tech., Plastics & Polymer Engg./Tech., Pulp & Paper Tech.
g) M.E. (Computer Science & Engineering)	Computer Science & Engineering, Computer Technology, Computer Engineering, Electronics Engg., Electronics & Telecommunication, Information Technology
h) M.E. (Information Technology)	Information Technology, Computer Science & Engineering, Computer Technology, Computer Engineering, Electronics & Telecommunication, Electronics Engineering
i) M.E. (Electronics & Telecommunication)	Electronics & Telecommunication, Electronics Engg., Industrial Electronics & Instrumentation

6. The Degree of Master of Engineering (Full-Time) / Master of Technology (Full-Time) shall be awarded to an examinee who in accordance qualifies in any one of the following subjects :-
   1) M.E. Civil (Structural Engineering)
   2) M.E. Mechanical (CAD/CAM)
   3) M.E. Digital Electronics
   4) M.E. Electrical (Electrical Power System)
   5) M.Tech. Chemical Technology (Membrane & Separation Technology)
   6) M.Tech. Chemical Engineering
   7) M.E. Computer Science & Engineering
   8) M.E. Information Technology
   9) M.E. Electronics & Telecommunication Engineering

7. (i) University shall hold Main Examinations of Semester-I of above mentioned Full Time Degree Courses in Winter every year and Supplementary Examinations in Summer every year at the end of the Second Semester
   (ii) University shall hold Main Examinations of Semesters-II, III & IV in Summer every year and Supplementary Examinations in Winter every year.
   (iii) The period of Academic session shall be such as may be notified in Academic Calender of the concerned academic session.

   (iv) Examinations shall be held at such places and on such dates as may be notified by Board of Examinations.

8. For the purposes of Instructions and Examinations, students shall study sequentially.

9. Subject to his/her compliance with the provisions of Ordinance relating to Examinations in General, the applicant for admission to an examination at the end of the course of study of a particular semester shall be eligible to appear at it, if;
   (i) He/She has satisfied the conditions mentioned in the following table and the provisions thereunder.

TABLE I

Sr. No.	Name of Exam.	The student should have completed the term satisfactorily of	The student should have passed the subjects of examination of
1.	M.E./M.Tech. Semester-I	Semester-I	----
2.	M.E./M.Tech. Semester-II	Semester-II	----
3.	M.E./M.Tech. Semester-III	Semester-III	2/3 heads of passing of Semester- I & II taken together
4.	M.E./M.Tech. Semester-IV	Semester-IV	----

(Explanation :- The Theory or Practical part of the subject shall be treated as separate head of Passing.)

   (ii) He/She shall not be allowed to submit the dissertation till he/she has passed in all subjects of I & II Semester.

10. The schemes of teaching & examinations shall be as provided under “Appendices A, B, C, D, E, F, G, H and I” appended with this Direction.

11. The fees for each M.E. (Full Time) / M.Tech. (Full Time) Examinations (Theory & Practical) shall be as prescribed by University from time to time.

12. The computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) of an examinee shall be as given below :-
    The marks will be given in all examinations which will include college assessment marks and the total marks for each Theory / Practical shall be converted into Grades as per Table II.

SGPA shall be calculated based on Grade Points corresponding to Grade as given in Table II and the Credits allotted to respective Theory / Practical shown in the scheme for respective semester.

SGPA shall be computed for I, II and IV Semester (**III & IV Semester together**) and CGPA shall be computed in IV semester based on SGPAs of I, II and IV Semester. :-

$$SGPA = \frac{C_1 \times G_1 + C_2 \times G_2 + ... + C_n \times G_n}{C_1 + C_2 + ... + C_n}$$

Where C_1 = Credit of individual Theory / Practial

G_1 = Corresponding Grade Point obtained in the respective Theory / Practical

$$CGPA\ X(Cr)_{IV} = \frac{(SGPA)_I \times (Cr)_I + (SGPA)_{II} \times (Cr)_{II} + (SGPA)_{IV}}{(Cr)_I + (Cr)_{II} + (Cr)_{IV}}$$

Where $(SGPA)_{I, II, IV}$ = SGPA of I, II & IV Semester

$(Cr)_{I, II, IV}$ = Total Credits for I, II & IV Semester

TABLE II

THEORY & PRACTICALS

Grade	Percentage of Marks	Grade Points
AA	85 £ Marks £ 100	10
AB	75 £ Marks < 85	9
BB	70 £ Marks < 75	8
BC	65 £ Marks < 70	7
CC	60 £ Marks < 65	6
CD	55 £ Marks < 60	5
DD	50 £ Marks < 55	4
FF	00 £ Marks < 50	0
ZZ	Absent in Examination	--

13. (i) The scope of the subject shall be as indicated in the syllabus.
    (ii) The medium of instructions and examination shall be English.
14. Provisions of Ordinance No.18 of 2001 in respect of an Ordinance to provide grace marks for passing in a Head of passing and improvement of Division (Higher Class) and getting distinction in the subject and condonation of deficiency of marks

in a subject in all the faculties prescribed by the Statute No.18, Ordinance, 2001 shall apply to each examination under this Direction.

15. An examinee, who does not pass or who fails to present himself/ herself for the examination, shall be eligible for readmission to the said examination on payment of fresh fees, and such other fees as may be prescribed by the University.
16. As soon as possible after the examination, the Board of Examinations shall publish a result of the examinees. The result of all examinations shall be classified as above and branchwise merit list shall be notified as provided under Original Ordinance No.6.
17. Notwithstanding anything to the contrary, no one shall be admitted to an examination, if he/she has already passed the said examination or an equivalent examination of any Statutory University.
18. (i) Examinees who have passed in all the subjects prescribed for all the examinations of the particular branch shall be eligible for award of the Degree of Master of Engineering/ Master of Technology in that branch including specilization.
    (ii) The Degree Certificate in the prescribed form shall be signed by the Vice-Chancellor.

Sd/-
Dr. Kamal Singh
Vice-Chancellor

*****

Two Year Post Graduate Degree Course in Master of Engineering (Part Time / Full Time)

Digital Electronics

Appendix - A

First Semester

Sr. No.	Subject Code	Subject	TEACHING SCHEME: HOURS / WEEK Lecture	Tutorial	Practical	Total HOURS	CREDITS	EXAMINATION SCHEME: THEORY DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS THEORY PAPER	MIN. PASSING MARKS SUBJECT	PRACTICAL MAX. MARKS EXTERNAL	MAX. MARKS INTERNAL	TOTAL	MIN. PASSING MARKS
01	1UMEF1	DIGITAL INSTRUMENTATION	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
02	1UMEF2	ADVANCED DIGITAL SIGNAL PROCESSING	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
03	1UMEF3	ELECTIVE-I	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
04	1UMEF4	DIGITAL COMMUNICATION TECHNIQUES	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
05	1UMEF5	EMBEDED SYSTEM DESIGN	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
06	1UMEF6	DIGITAL COMMUNICATION TECHNIQUES-LAB.	0	0	2	2	1	_	_	_	_	_	_	25	25	50	25
07	1UMEF7	EMBEDED SYSTEM DESIGN-LAB.	0	0	2	2	1	_	_	_	_	_	_	25	25	50	25
		TOTAL	20	0	4	24	22				500					100	
															TOTAL		600

Elective - I : 1) Modern Electronic Design Techniques 2) RF System Design 3) Computer Communication Network

Second Semester

Sr. No.	Subject Code	Subject	TEACHING SCHEME: HOURS / WEEK Lecture	Tutorial	Practical	Total HOURS	CREDITS	EXAMINATION SCHEME: THEORY DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS THEORY PAPER	MIN. PASSING MARKS SUBJECT	PRACTICAL MAX. MARKS EXTERNAL	MAX. MARKS INTERNAL	TOTAL	MIN. PASSING MARKS
01	2UMEF1	DIGITAL IMAGE PROCESSING	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
02	2UMEF2	CMOS VLSI DESIGN	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
03	2UMEF3	PARALLEL COMPUTING	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
04	2UMEF4	ARTIFICIAL INTELLIGENT SYSTEMS	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
05	2UMEF5	ELECTIVE-II	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
06	2UMEF6	DIGITAL IMAGE PROCESSING-LAB.	0	0	2	2	1	_	_	_	_	_	_	25	25	50	25
07	2UMEF7	CMOS VLSI DESIGN-LAB.	0	0	2	2	1	_	_	_	_	_	_	25	25	50	25
		TOTAL	20	0	4	24	22				500					100	
															TOTAL		600

Elective - II : 1) Bio-Informatics 2) Micro Electro Mechanical System 3) High Speed Digital System Design

Appendix - B

Third Semester

Sr. No.	Subject Code	Subject	Lecture	Tutorial	Practical	Total	CREDITS	INTERNAL MARKS	TOTAL	MIM. PASSING MARKS
01	***3UMEF1***	SEMINAR AND DISSERTATION	_	_	6	6	15	100	100	50
		TOTAL	_	_	***6***	***6***	***15***		***100***	

TOTAL 100

Fourth Semester

Sr. No.	Subject Code	Subject	Lecture	Tutorial	Practical	Total	CREDITS	EXTERNAL MARKS	INTERNAL MARKS	TOTAL	MIM. PASSING MARKS
01	***4UMEF1***	SEMINAR AND DISSERTATION	...	...	12	12	30	200	100	300	150
		TOTAL	_	_	***12***	***12***	***30***			***300***	

TOTAL 300

GRAND TOTAL 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.).

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of III semester jointly for III & IV semester.

2. Single marksheet for III & IV semester together will be given to the student.

Two Year Post Graduate Degree Course in Master of Engineering (Full-Time)
Electronics and Telecommunication Engineering

Appendix - A

First Semester

			TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK					THEORY						PRACTICAL			
Sr. No.	Subject Coce	Subject	Lecture	Tutorial	Practcal	Tota HOURS	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS		MAX. MARKS		TOTAL	MIN. PASSING MARKS
												THEORY PAPER	SUBJECT	EXTERNAL	INTERNAL		
01	1ENTC1	Advanced Optical Communication	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
02	1ENTC2	Random Processes	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
03	1ENTC3	Digital Communication Techniques	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
04	1ENTC4	Digital Signal Processing and Applications	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
05	1ENTC5	Elective - I	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
06	1ENTC6	Lab – I (based on 1ENTC1 & 1ENTC3)	0	0	2	2	1	_	_	_	_	_	_	25	25	50	25
07	1ENTC7	Lab – II (based on 1ENTC4)	0	0	2	2	1	_	_	_	_	_	_	25	25	50	25
		TOTAL	20	0	4	24	22				500					100	
															TOTAL		600

Elective - I : 1) Real Time Embedded System 2) Data Compression 3) Artificial Intelligent System 4) Cryptography & Network Security

Second Semester

01	2ENTC1	Adaptive Signal Processing	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
02	2ENTC2	Wireless Communication	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
03	2ENTC3	Advanced Computer Networks and Programming	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
04	2ENTC4	RF & Microwave Circuit Design	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
05	2ENTC5	Elective - II	4	0	0	4	4	3	80	20	100	40	50	_	_	_	_
06	2ENTC6	Lab – I (based on 2ENTC2 & 2ENTC3)	0	0	2	2	1	_	_	_	_	_	_	25	25	50	25
07	2ENTC7	Lab – II (based on 2ENTC1 & 2ENTC4)	0	0	2	2	1	_	_	_	_	_	_	25	25	50	25
		TOTAL	20	0	4	24	22				500					100	
															TOTAL		600

Elective - II : 1) Mobile Computing 2) Communication System Design 3) Optical Networks 4) Speech & Audio Processing

Appendix - B

Third Semester

Sr. No.	Subject Code	Subject	Lecture	Tutorial	Practical	Total	CREDITS	INTERNAL MARKS	TOTAL	MIM. PASSING MARKS
01	3ENTC1	SEMINAR AND DISSERTATION	_	_	6	6	15	100	100	50
		TOTAL	_	_	6	6	15		100	

TOTAL 100

Fourth Semester

Sr. No.	Subject Code	Subject	Lecture	Tutorial	Practical	Total	CREDITS	EXTERNAL MARKS	INTERNAL MARKS	TOTAL	MIM. PASSING MARKS
01	4ENTC1	SEMINAR AND DISSERTATION	_	_	12	12	30	200	100	300	150
		TOTAL	_	_	12	12	30			300	

TOTAL 300

GRAND TOTAL 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.).

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of III semester jointly for III & IV semester.

2. Single marksheet for III & IV semester together will be given to the student.

SYLLABUS PRESCRIBED FOR TWO YEAR P.G.DEGREE COURSE IN ME (DIGITAL ELECTRONICS) (Part Time/ Full Time)

1UMEF1/1UMEP1 DIGITAL INSTRUMENTATION

Unit :I Digital Time & Frequency Measurement Technique:

1. Vernier technique for small time interval measurement, Measurement of Periodic time, Measurement of Phase, Capacitance, Quality factor, Time constant and dB.
2. Measurement of ratio, product and difference between two frequencies, High frequency measurement, Maximum and Minimum frequency measurement, Peak frequency measurement, Fast low frequency measurement.

Unit :II Electronic Instruments for Signal Analysis & Signal Analyzer: Spectrum analyzer, wave analyzer, distortion analyzer, Network analyzer, logic analyzer, protocol analyzer.

Unit:III- Automated Measurement Systems:Need and requirement of automatic test equipment (ATE),Computer based and computer Controlled ATE, Switches in ADTEW, ATE for PCB and component testing,IEEE-488 electronic bus standard, field bus application, Instrumentation in hazardous area.

Unit :IV Microcontroller and PC Based Data Acquisition Systems: Introduction to Smart /Intelligent sensors and Digital sensors, Data Acquisition systems, Types of Data Acquisition systems, Case studies of real time PC based instrumentation systems, Virtual instruments, Intelligent instruments**.**

Unit :V Computer Control-I Microprocessor interfacing and computer based instrumentation, Hierarchy of computer control for industry, Direct Digital Control, Digital PID control algorithms, Distributed computer control, System

architecture and implementation concepts, buses and communication network of DCCS, SCADA systems.

Unit:VI 1. **Computer Control-II**Intelligent Controllers: Discrete state process control, Relay sequencer and ladder diagram, Programmable Logic Controllers(PLC), PLC programming techniques, Introduction to Fuzzy logic and Neutral Network Controllers.

2. **Medical Instrumentation Systems:**Real time digital conditioning of monitored bio-medical signals such as EEG, ECG, EMG.

Text Books:

1. “Digital Measurement Techniques”, T. S. Rathore, Narosa Publishers
2. ”Process Control and Instrumentation Technology”, C. Johnson, 5th Edition , PHI
3. ”Computer Based Industrial Control”, Krishna Kant, 2nd Edition PHI

Reference Books:

1. “Electronics Instruments Handbook,”, C.E.Coombs, McGraw Hill international
2. ”Applied Electronic Instrumentation and Measurements”, McLachalan& Buchla , PHI
3. ”Hand Book of Biomedical Instrumentation”, RSKhandpur, PHI
4. “Sensors and signal conditioning”, Webster, John,Wiley & sons
5. “Digital Signal Processing”, Cavicchi, John Wiley & sons

1UMEF2/1UMEP2 ADVANCED DIGITAL SIGNAL PROCESSING

Unit I: Overview of discrete time signal and systems: Convolution, correlation, Time bandwidth relationship, Different transforms and their properties, use of DFT in linear filtering, filtering of long data sequences, Algorithm for convolution and DIT-FFT and DIF-FFT algorithm.

Unit II: Filter Design : Analog filter design, Discrete time IIR filter from analog filter, IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives, HPF, BPF, BRF filter design using frequency translation, Structures of FIR, Linear phase, FIR filter, Filter design using windowing techniques and Frequency sampling techniques.

Implementation of Filter using filter structure.

Unit III: Introduction to Multi-rate Digital Signal Processing: Sample rate reduction, decimation by integer factors-sampling rate increase, interpolation by integer facto, Design of practical sampling rate converters, Filter Specification-filter requirement for individual stages, Determining the number of stages and decimation factors, Sampling rate conversion using poly-phase filter structure, poly-phase implementation of interpreters.

Unit IV: Adaptive Signal Processing : Adaptive filters, Concepts-Adaptive filter as a Noise Canceller, Other configurations of the adaptive filter, Main components of the adaptive filter, Basic Wiener filter theory, The basic LMS adaptive algorithm, Practical limitations of the basic LMS algorithm, Recursive Least Square Algorithm, Limitations, Factorization Algorithm.

Unit V: Introduction to two dimensional signal and Systems: 2D, Discrete Fourier Transforms, Properties and applications, Discrete Hilbert Transform and Discrete Cosine Transform, Properties and Applications, Short term Fourier Transform, Gabor Transform, Properties and Applications.

Unit VI: General and special purpose DSP Processors: Computer Architecture for signal processing, Havard Architecture, Pipelining, Hardware Multiply and Accumulate, Special Instructions, Replication, On-chip

Memory Cache, Extended Parallelism, SIMD, Architecture and programming of TMS320 C67XX, Application of DSP to biomedical Signal Processing.

References Books :

1. "Digital Signal Processing" Emmanuel C Ifeachor, Barrie W Jrevis, Pearson Education.
2. "Theory and Applications of DSP", L.R Rabiner and B. Gold
3. "Electronic Filter Design", Hand Book A .B Williams and FT Taylor, McGraw Hill
4. "Wavelets and Subband Coding", Valterli & Kovaceric, PHI.
5. "Analog Devices & Texas Instruments", Users Manuel of TMS320C4X and ADSP 2106x.
6. "Digital Signal Processing": Principles, Algorithms & Applications", John G. Proakis & Dimitris G.Manolakis, Fourth edition, Pearson education / Prentice Hall, 2007.
7. "Digital Signal Processing – A Computer Based Approach" , Sanjit K. Mitra, Tata McGraw Hill, Third Edition, 2007 .
8. "Discrete Time Signal Processing", Alan V. Oppenheim, Ronald W. Jchafer & Hohn. R. Back, PHI / Pearson Education, Second Edition, 2001.
9. "Digital Signal Processing", Andreas Antoniou, Tata McGraw Hill.
10. "Digital Signal Processing using Matlab and wavelets", Michael weeks Infinity Science Press

1UMEF3/1UMEP3 ELECTIVE –I

(1) MODERN ELECTRONICS DESIGN TECHNIQUES

Unit: I Amplifiers Design : Digital isolation techniques, High speed clamping amplifiers, Programmable gain amplifiers, Auto-zero amplifiers, Lock-in amplifiers.

Unit:II Power Regulator Design: Switch Mode Regulator topologies like buck, boost, buck-boost their control techniques and selection of passive, active and magnetic components for these regulators

Unit:III Communication and Control System Design: Electronic navigation systems, Underwater sound systems, Phase lock loop design, Direct digital synthesis.

Unit:IV Electronic Systems for Aircrafts Radio systems and Autopilot systems in aircraft, Digital engine control and motion control systems for automobiles.

Unit:V Portable Electronic System Design: Types and characteristics of modern batteries, Portable devices like Mobile TV, VoIP phones, Glucose meter, Pulse Oximetry, Cardio Pulmonary Resuscitation systems, Ultrasound systems, Barcode readers, Payment terminals. Smart battery management systems

Unit:VI Electronic System Design for Production: Layout and grounding for analog and digital systems, Safety, Testability, Reliability and Thermal management in electronic systems, Quality, reliability, testing and environmental aspects in printed circuit board design, Design of enclosures for electronic products, EMC of electronic products

Text Books:

1. "Linear Circuit Design Handbook", Analog Devices Corporation (Editor: Zumbahlen), Elsevier 2008
2. "Demystifying Switching Power Supplies" Mach, Elsevier, 2005
3. "Circuit Design – Knowit All", Ashby, Baker, Elsevier, 2008
4. "Standard Handbook of Electronics Engineering" Chritiansen & Alexander, 5th ed McGraw Hill, 2008

Reference Books:

1. "Digital Frequency Synthesis Demystified", Goldberg, LLH Publishers
2. "Aircraft Digital Electronic and Computer Systems", Tooley, Elsevier 2007
3. "Aircraft Electricity and Electronics", Bent
4. "Battery Operated Devices and Systems", Pistoia, Elsevier, 2008
5. "Understanding Automotive Electronics", 6th ed Ribbens, Elsevier, 2003

6. "Grounding and Shielding Circuits and Interference", 5th ed Morrison, Wiley, 2007
7. "Printed Circuit Boards" Khandpur, McGraw Hill, 2008

1UMEF3/1UMEP3 ELECTIVE –I

(2) RF SYSTEM DESIGN

Unit: I Active RF Components: Semiconductor Basics: Physical properties of semiconductors, PN-Junction, Schottky contact.**Bipolar-Junction Transistors:** Construction, Functionality, Temperature behavior, Limiting values. **RF Field Effect Transistors:** Construction, Functionality, Frequency response, Limiting values.

Unit:II High Electron Mobility Transistors: Construction, Functionality, Frequency response. **Active RF Component Modeling:** Transistor Models: Large-signal BJT Models, Small-signal BJT Models, Large-signal FET Models, Small-signal FET Models.

Unit:III RF filter Design methods: Image Parameter Method, Insertion Loss Method, Microstrip Filter Design **Filter Implementation:** Unit Elements, Richard's Transformation, Kuroda's Identities and Examples of Microstrip.

Unit:IV High frequency amplifier design: Bandwidth enhancement, neutralization and unilateralisation, cascaded amplifiers. **RF power amplifier design:** Class A to Class F amplifiers and modulation characteristics.

Unit:V LNA, Mixers and oscillators design LNA topologies and their design, linearity and large signal performances, multipliers and sub sampling mixers, High Frequency Oscillator Configuration: Fixed Frequency Oscillator, Voltage Controller Oscillator and Dielectric Resonator Oscillator

Unit:VI PLL design Linearized PLL models, Noise properties of PLLs, Phase detectors, Sequential phase detectors, Loop filters and charge pumps, design examples.

Text Books :

1. "Microwave Transistor Amplifiers, Analysis and Design", G. Gonzalez; Prentice Hall
2. "RF Circuit Design-Theory and Applications", Reinhold Ludwig and Pavel Bretchko; Pearson Education

Reference Books :

1. " The Design of CMOS RF ICs", Thomas Lee, Cambridge second edition
2. "Microwave Engineering", David M. Pozar; Wiley & Sons (ASIA) Pvt. Ltd.
3. "Radio Frequency and Microwave Electronics", Matthew M Radmanesh
4. "Microwave Circuit analysis and Amplifier Design", S. Y. Liao; Prentice Hall

1UMEF3 /1UMEP3 ELECTIVE –I

(3) COMPUTER COMMUNICATION NETWORKS

Unit: I Review of computer networking: ISO-OSI reference model, Point to point Protocol, ARQ techniques, Data network switching techniques.

Unit:II TCP/IP: TCP/IP architecture, TCP Segments, TCP flow control, IPv4 versus IPv6, UDP, Fragmentation, ARP & RARP , ICMP,IGMP, DHCP, UnIcast and Multicast Routing protocols.

Unit:III Network management: Delay models in data networks, Performance measures & architecturalIssues, Queuing Model (M/M/1, M/M/C, and M/G/1), Network management and congestion control algorithm.

Unit:IV Multiple access technique: Aloha and Slotted Aloha, CSMA/CD, CSMA/CA, CDMA, OFDM, Delay throughput characteristics,

Unit:V Wireless network: WAP architecture, Wireless LAN, Zig-Bee functional architecture and specifications, Ad-hoc Network

Unit:VI Network security: Ciphers, DES, public key cryptography, RSA algorithm, Digital water marking, Attack and counter measure.

Text Books :

1. "Communication Networks", Leon Garcia & Wadeja, Tata McGraw Hill Publication.
2. "Computer Networks and Internetworking", D.E.Comer, Pearson Education

Reference Books :

1. "Data Networks" Dimitri Bertisekas & Robert Gallager, PHI
2. "Local Area Networks", Gerd E Kieser – Mc-Graw-Hill
3. "Cryptography and Network Security: Principles and Practice", William Stallings, Pearson Education
4. "GSM, CDMA and 3G Systems" , Steele,, Wiely Students Edition

1UMEF4 /2UMEP1 DIGITAL COMMUNICATION TECHNIQUES

Unit:I Characterization of Communication Signal and Optimum Receiver for AWGN Channel:- Signal Space representation, Memory less Modulation methods, Linear Modulation with memory, Non- linear Modulation methods with memory, CPFSK & CPM, Power Spectra of Linear Modulated signal, Power Spectra of CPFSK & CPM Signals, Correlation Demodulator, Match Filter Demodulator, Optimum Detector, Probability of Error for Binary & M-array signals

Unit:II **Source Coding:-** Average mutual information & Entropy, Coding of discrete memory-less sources, Discrete Stationary Sources, Lempel-Ziv algorithm; Coding of analog sources, Rate distortion function, Scalar Quantization & Vector Quantization,

Unit:III **Channel Coding:-** Temporal and Spectral Waveform Coding, BCH codes, Reed Soloman codes, Reed Muller Codes, Convolution Codes, Transfer function of convolution codes, Viterbi decoding algorithm, stack algorithm(No problems expected)., trellis coded modulation.

Unit:IV **Signal Design for Band Limited Channel:**-Design of band limited signal for zero ISI, Nyquist Criterion, Design of band limited signal for controlled ISI, partial response signaling, Data detection for controlled ISI

Unit:V **Linear Equalization Techniques :** Peak Distortion Criterion, Mean Square Error (MSE) criterion, Decision Feedback Equalization, Coefficient Optimization, Adaptive Linear Equalizer, Zero Forcing Algorithm, LMS Algorithm.

Unit:VI **Spread Spectrum Techniques:-**Generation of PN sequence, direct sequence spread spectrum system, processing gain, jamming margin, application of direct sequence spread spectrum signal, frequency hopped spread spectrum signal, time hopping spread spectrum signal, synchronization of spread spectrum signal – acquisition & tracking.

Text Books:

1. "Digital Communication Fundamentals and Applications", Bernard Sklar, 2nd Ed, Pearson Education Asia
2. "Digital Communication", J.G. Proakis, Fourth Ed, Mc Graw Hill
3. " Error Control Coding – Fundamentals & Applications," Shu Lin & Costell , Addison Wessley Pub.

Reference Books:

1. "Digital Communication Techniques", Simon Haykin, John Wiley & Sons.

2. "Advanced Digital Communication System and Signal Processing Techniques", Dr.Kemilo Feher Prentice Hall International.

1UMEF5/2UMEP2 EMBEDDED SYSTEM DESIGN

Unit:I **Embedded System hardware :** Embedded systems overview, Hardware components like microcontroller, GPP, ASSP, AISP, SOC, Details of 32 bit ARM**7** core based SoC architecture, Organisation, analog, digital & high speed I/O for embedded systems, interfacing SRAM, DRAM, flash memories with microcontroller, memory management

Unit:II **Embedded System Software :** Techniques of writing efficient C code for microcontroller C data types for ARM, Signed & unsigned data types, limitation of char & char & data types, storage class – static & extern, volatile keyword, operation on bits, functions, ARM / Thumb procedural call standard, pointers & arrays, conditional statements – if-else, switch, structure, conditional loops – for & while, preprocessing, compiling, cross compiling, compiler driver, startup code and board support packages, calling assembly routines in C, interrupt handling in C, interrupt latency.

Unit:III **ARM Philips NXP LPC2148 microcontroller - *Programming & Interfacing:*** Programming on – chip components like ADC, UART, Timers, External Interrupts and interfacing external peripherals like keyboard, LCD, Stepper motor.

Unit:IV **Uniprocessor Real Time Operating Systems – I:** Real time systems, goals and services, tasks and its states, task assignment & scheduling, Task Control Blocks, Context & Context Switching, ISRs, Security Issues, inter- task communication, semaphore.

Unit:V **Uniprocessor Real Time Operating Systems – II:** Task Scheduling models**,** scheduling algorithms – rate monotonic and earliest deadline first, priority inheritance

protocol, priority ceiling protocol, real time operating system features, features of micro COS – II RTOS.

Unit:VI Embedded System Architecture & Design : Architecture styles, implementation aspects, estimation modeling, embedded system architecture, validation and debugging of embedded systems, hardware – software co-design in an embedded system.

Text Books :

1. "Embedded Systems", Rajkamal 2nd Edi Tata McGraw Hill.
2. "Embedded Real-time Systems Programming", Lyer & Gupta Tata McGraw Hill

Reference Books :

1. "ARM System on Chip Architecture", 2nd Ed Furber, Pearson India
2. "Introduction To Embedded Systems", K.V. Shibu, MGH.
3. Philips NXP LPC 2148 User Manual
4. "Scheduling in Real Time Systems", Cottet, Delacroix & Mammeri, John Wiley & Sons.

SEMESTER - II

2UMEF1/3UMEP1 DIGITAL IMAGE PROCESSING

Unit:I Image processing fundamental: Basic image processing Steps, Digital image representation, Image acquisition ,sampling and quantization, basic relationship between pixels, distance measures ,point operations ,Human visual system, Image types, zooming operation ,

Unit:II Image enhancement in spatial domain : Basic gray level transformations, Histrogram processing, Arithmatic and logic operations, ,spatial domain filtering ,bit-plane slicing, median filter, color image processing fundamentals and color models.

Unit:III Image Transforms: 2D DFT, Walsh transform ,Hadamard transform,Slant transform, Discrete transform, KL transform, Radon transform and Multiresolution wavelet transform.

Unit:IV Image enhancement in the frequency domain:Filtering in frequency domain, Homomorphic filter, Image Restoration and Denoising ,Image degradation models, Types of image blur, image restoration model, linear image restoration, nonlinear image restoration techniques, blind deconvolution and classification technique ,image denoising, noise in image.

Unit:V Image segmentation: Detection of discontinuities, edge-based segmentation , edge detection,edge linking, Hough transform , Thresholding ,region based segmentation, watershed transformation, shape representation and classification,Morphological techniques, Object & pattern recognition & interpretation method.

Unit:VI Image Compression : Lossy block truncation & vector quantization , lossless Huffman coding, run length coding & block coding , transform coding. Image processing standards

Text Books :

1. “Digital Image Processing", R.C Gonzales & Woods –Addison Wesley IIIrd Ed.
2. “Digital Image Processing”, S Jayaraman, S Esakkirajan,T Veerakumar- Tata Mc Graw Hill.

Reference Books :

1. “ Fundamental Digital Image Processing “by A.K.Jain –Prentics Hall Inc.
2. “Digital Image Processing”, W.K Pratt IIIrd ed John Wiley
3. “Digital Image Processing and Analysis”, B Chanda and D. Mujumdar-PHI new Delhi

2UMEF2/3UMEP2 CMOS VLSI DESIGN

Unit I: CMOS design methods & Testing: Basic Physical Design of Simple Logic Gates, Design Strategies, CMOS chip design - Sea-of-Gate and Gate Array, standard cell design, CMOS Testing: Functionality Tests, Manufacturing Test, Fault models, Observability, Controllability, Fault Coverage, Design for Testability - Scan based Techniques

Unit: II: CMOS subsystem design: Addition/Substration, Parity Generator, Comparators, Counters, Shifters, Multipliers, Memories - SRAM, DRAM,

Unit III: CMOS Analog Integrated Circuits: Components of analog CMOS ICs, Parametric estimation of R,L & C of CMOS transistors, High-frequency behavior of basic ampliûer, High speed comparators, Switch capacitor filters,

Unit IV: CMOS RF Integrated Circuits : Design of LNA, Mixer, RF Power Amplifiers, Linearization, Oscillator, PLL

Unit V: ASIC Construction: Physical design, CAD tools, system partitioning, ASIC size estimation, Power dissipation issues, FPGA partitioning methods

UnitVI: Floor planning, Placement, physical design flow, information formats, global routing, detailed routing, special routing, circuit extraction and DRC , Deep-Submicron to Nanoscale Technologies, Design of a Simple Microprocessor & Configurable Logic Circuits.

Text Books :

1. "Application Specific IC" Michael John Sebastin, Smith Addison, Wesley Publication
2. "The Design of CMOS Radio-Frequency Integrated Circuits" Thomas H. Lee, Cambridge University press
3. "Advanced CMOS Cell Design", Etienne Sicard, Sonia Delmas Bendhia Mc Graw Hill publication.

Reference Books :

1. "Principles of CMOS VLSI Design" Neil Weste and Eshraghian, Person Education
2. "CMOS Analog Circuit Design" Phillip F. Allen, Douglas R. Holberg, Oxford University Press
3. "VLSI Design" M. Michael Vai, CRC press

2UMEF3/4UMEP1 PARALLEL COMPUTING

Unit I: Parallel Computer models: Flynn's classification, system attributes to Performance, multiprocessor and multicomputer, shared memory multiprocessors, Distributed – Memory Multicomputer, A Taxonomy of MIMD Computers, conditions of parallelism, Data and Resource Dependence, Hardware and Software Parallelism, Roll of Compilers and speed up performance laws.

Unit II: Program partitioning and scheduling: grain size and latency, grain packaging and scheduling. Static multiprocessor scheduling, program flow mechanisms, control flow versus dataflow, demand driven mechanism, comparison of flow mechanism, Static connection network and Dynamic connection network.

Unit III: Linear pipeline processors: Asynchronous and synchronous models, clocking and timing control, speed up, efficiency and throughput. Non-Linear pipeline processors: reservation and latency analysis, collision free scheduling, pipeline scheduling optimization, instruction pipeline design, arithmetic pipeline design, super scalar and super pipeline design.

Unit IV: Parallel and scalable architectures Multiprocessor system interconnects: Network characteristics, hierarchical bus systems, crossbar switch and multiport memory, multistage and combining networks, cache coherence and synchronization mechanisms, snoopy bus protocols, directory bus protocols, hardware synchronization

mechanism, massage routing scheme and deadlock and virtual channels.

Unit V : Scalable, multithread and dataflow architecture: latency hiding techniques: shared virtual memory, prefetching techniques, distributed coherent cache, scalable coherence interface, relaxed memory consistency, Principles of multithreading, multithreading issues and solutions, multi-context processors, multi-dimensional architectures, fine grain parallelism, the scalable multi-threading architectures, the stand ford dash multiprocessor, tera-multiprocessor systems and data flow and hybrid architectures.

Unit:VI Parallel Program Development and Environment: Parallel Programming Computers, Parallel Programming environments, Synchronization and multiprocessing modes, multitasking, Microtasking , autotasking, shared variable program structure, semaphores and applications, message passing program development, control decomposition techniques, heterogeneous processing.

Text Book :

1. "Advanced Computer Architecture, Parallelism, Scalability, Programmability". Kai Hwang, McGraw Hill Inc. second Edition, 2011.

Reference Books :

1. "Elements of Parallel Computing", V. Rajaraman , PHI, 1990
2. "Computer Architecture and Parallel Processing", Kai Hwang. F. A. Briggs, McGraw Hill, 1985.
3. "Computer organization & Architecture ", William Stallings, PHI, New Delhi. 6th Edition.
4. "Kalsuk' Advanced Computer Architectures", Dezso'Sima. Terence Fountain & Peter, Pearson's Edition, 2nd Edition.
5. "Parallel Processing for Supercomputers and AI", Hwang and Degroot (Eds) McGraw Hill.

6. "Computer Architecture: A Quantitative Approach". John L. Hennessy , David A. Patterson, Morgan Haufmann, Elsevier. 4th edition, 2007.
7. ''Computer Architecture: Hardware & Software Approach", John L. Hennessy, David A. Patterson. Elsevier, 3rd Edition, 2005.
8. "Advanced Computer Architecture: A Design Space Approach", Sima, Fauntain, Kscucle. Pearson 7th edition. 2009.

2UMEF4/4UMEP2 ARTIFICIAL INTELLIGENT SYSTEM

Unit I: Introduction to Fuzzy Set Theory: Fuzzy set theory, classical set theory, properties of fuzzy sets, operations on fuzzy sets, fuzzy relations, operation on fuzzy relations, extension principle, fuzzy arithmetic membership functions, fuzzification & defuzzification.

Unit II: Fuzzy Rules, Reasoning & Decision Making:**Fuzzy reasoning:** introduction, linguistic variables, fuzzy propositions.**Fuzzy rules**: fuzzy rule based system, fuzzy if-then rules, fuzzy inference system. **Fuzzy decision making**: individual, multiperson, multicriterion and multistage decision making fuzzy ranking methods.

Unit III:Hybrid Systems:**Fuzzy controller:** construction of FLC, fuzzy PD controller, fuzzy PI controller. **Neuro-fuzzy control:** introduction, inverse learning, specialized learning.**Fuzzy pattern recognition:** introduction, single sample identification, multi-feature recognition.

UnitIV: Artificial Neural Networks Introduction, biological neuron, Artificial neural models, Perceptron Learning rule, Single layer perception, multilayer perceptron network, error back propagation algorithm.

Unit V: Unsupervised Learning: Winner-Take-All learning algorithm, hamming net and Maxnet , self organization feature map, Adaptive Resonance Theory (ART) network,

Counter propagation network,**Associative Memories**: Linear associator, Hopfield recurrent associative memory, storage and retrieval algorithm, basic concept of bidirectional associative memory (BAM).

Unit VI: **Support vector machines (SVM):** Optimal hyperplane for linearly separable and non-separable patterns, SVM as a Kernel machine, design of SVM **Genetic algorithm:** Introduction, encoding, fitness function, reproduction, crossover, mutation. Simulated annealing Applications of neural network in character recognition, forecasting, robot kinematics, biomedical signals. Optical neural network

Text Books:

1. "Neural Networks", S. Hykin, Pearson Education.
2. "Fuzzy Sets and Fuzzy Logic Theory and Applications", George J. Klir, Bo Yuan, PHI
3. "Fuzzy Logic With Engineering Applications", Timothy Ross, McGraw Hill international

Reference Books:

1. "Artificial Neural Networks", Zurada.
2. "Neuro Fuzzy and Soft Computing", Jang, Sun, Mezutani.
3. "Introduction to Neural Networks using MATLAB 6.0", S.N.Sivanandan, S. Sumathi, S.N. Deepa, McGraw Hill.
4. "Neural Networks, Fuzzy Logic and Genetic Algorithms Synthesis and Applications", S. Rajasekaran, G.A. Vijayalakshmi Pai, PHI
5. "Intelligent Systems & Controls", Laxmidhar Behera, Indrani kar , Oxford

2UMEF5/4UMEP3 ELECTIVE–II

(1) BIOINFORMATICS

Unit I: Introduction to bioinformatics, Bio informatics: Applications and research, Present Bioinformatics scenario in India, characterization in bioinformatics databases, categories of

bioinformatics databases, navigating databases, information retrieval systems

Unit II: Biological sequence database: Nucleotide sequence database, Secondary Nucleotide sequence database, literature database, protein sequence databases, secondary and specialised protein sequence databases, Gene expressing database.

Unit III: Structure databases, structure file formats, , protein Structure databases collaboration, PDB, MMDB, CATH, FSSP, DALI, SCOP, other databases, enzyme databases, MEROPS, BRENDA, pathway databases, CAZy, disease databases, literature databases, other specialised databases

Unit IV: Tools: Need for tools, knowledge discovery Industry trends, data-mining tools, Data submission tools, nucleotide sequence submission tools, protein submission tools, command line tool for GenBank, data analysis tools, prediction tools: phylogenetic trees and phylogeneti analysis, gene prediction, protein structure function prediction

Unit V: Classification of Algorithms, Implementing Algorithms, Biological Algorithms, bioinformatics tasks and corresponding Algorithms, Algorithms and bioinformatics software

UnitVI: **Data Analysis Algorithms:** Sequence comparison algorithms, substitution matrices, sequence alignment optimal algorithms **Prediction Algorithms:** Gene prediction algorithms, phyrogenetic prediction algorithms, protein structure prediction.

Text Books :

1. "Bioinformatics Databases, Tools and Algorithm", Orpita Bosu & Simminder Kaur Thukral, Oxford Uni. Press
2. "Bioinformatics Principles & Application", Zhumur Ghosh & Bikekanand Mallick, Oxford Uni. Press.

Reference Book:

1. "Introduction to Bioinformatics", Artur M. Lesk, Oxford Uni. Press.

2UMEF5/ 4UMEP3 ELECTIVE – II

(2) MICRO ELECTRO MECHANICAL SYSTEMS

Unit I: Overview of MEMS: The development of MEMS Technology, MEMS challenges, MEMS and Microsystems definitions and examples, Difference between Microsystems and Microelectronics, Benefits of miniaturization

Unit II: MEMS Applications in Industrial/automotives sensors, Medical systems, aircraft sensors, Structural health monitoring, Telecommunication etc, Materials for MEMS.

Unit III: Scaling Laws in Miniaturization: Introduction to Scaling, Scaling in Geometry, Scaling in Electrostatic forces. MEMS Design Considerations

Unit IV: Micro Fabrication –I: Introduction, Photolithography, Photoresists and Application, Light Sources, Photoresist Removal, Ion Implantation, Diffusion, Oxidation, Physical Vapor Deposition (PVD), Chemical Vapor Deposition (CVD), Sputtering, Deposition by Epitaxy, Etching.

Unit V: Micro Fabrication – II: Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison. Surface Micromachining: Process, associated Mechanical problems (Adhesion, Interfacial stresses, Stiction), LIGA process, MEMS Packaging

Unit VI: MEMS devices and Structures Microsensors: Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors. Microactuation: Actuation using thermal forces, Piezoelectric crystals,

Electrostatic forces, MEMS with microactuators: Microgrippers, Micromotors, Microgears, Micropumps

Text Book:

1. "MEMS & Microsystems Design and Manufacture", Tai-Ran Hsu, Tata McGraw Hill.

Reference Books:

1. "Micro Electro Mechanical System Design", James J.Allen, CRC Press, 2005
2. "Fundamentals of Micro Fabrication", Marc Madou, CRC Press.
3. "The MEMS Handbook", Mohamed Gad-el-Hak, CRC Press
4. "Micro and Smart Systems", G.K.Anantha Suresh, Wiley, India.
5. "Foundations of MEMS", Chang Liu, Pearson Education Inc., 2006.
5. “An Introduction to Micro Electro Mechanical System Design”, Nadim Maluf, Artech House, 2000.
7. “MEMS & Micro systems Design and Manufacture”, Tai Ran Hsu, Tata McGraw Hill, New Delhi.
8. "Micro Sensors MEMS Smart Devices", Julian W. Gardner, Vijay K. Varadan, Osana O. Awadelkarim, John Wiley & Sons Ltd, 2002.

2UMEF5/4UMEP3 ELECTIVE – II

(3) HIGH SPEED DIGITAL SYSTEM DESIGN

Unit I: The Importance of Interconnect Design, Ideal Transmission Line Fundamentals,Crosstalk, Crosstalk Estimation.

Unit II: Non ideal Interconnect Issues, Concentric-Ring Skin-Effect Model, Connectors, Packages, and Vias.

Unit III: Nonideal Return Paths, Simultaneous Switching Noise, Power Delivery

Unit IV: Buffer Modeling, Digital Timing Analysis, Clock Repeaters, Zero-Delay Clock Repeaters, Clock Jitter.

Unit V: Design Methodologies, Radiated Emissions Compliance and System Noise Minimization.

Unit VI: High-Speed Measurement Techniques, Digital Oscilloscope, Time Domain Reflectometry, Vector Network Analyzer.

Text Books :

1. "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices" Stephen H. Hall Garrett W. Hall, James A. McCall, John Wiley & Sons, Inc.
2. "High-Speed Digital Design: A Handbook of Black Magic" Howard Johnson, Prentice Hall publication

Reference Books:

1. "High Speed Signal Propagation: Advanced Black Magic" Howard W. Johnson, Prentice Hall
2. " Signal Integrity Issues and Printed Circuit Board Design" Douglas Brooks, Prentice Hall
3. "Signal Integrity, Simplified" Eric Bogatin, Prentice Hall
4. " Noise Reduction Techniques in Electronic Systems" Henry Ott -John Wiley & Sons.

SYLLABUS PRESCRIBED FOR TWO YEAR P.G.DEGREE COURSE IN

ME (ELECTRONICS & TELECOMMUNICATION ENGG.)

(Full Time) (Credit Grade System)

SEMESTER - I

1 ENTC1 ADVANCED OPTICAL COMMUNICATION

Unit I: Introduction to guided optical communication. Optical Fibers, types of fibers & optical Cables, Study of losses during transmission through viz. Attenuation by Absorption &Scattering, Consideration of losses in designing of High Speed / High bandwidth optical communication systems, Selection of fiber for such systems

Unit II: Optical Sources: Types of LEDs used in optical communication, their construction & operating principle, Types of Lasers. Principle of working of Lasers, solid state & injection Lasers.

Unit III: Optical amplifiers, EDFA, Soliton Systems & design of system required in LAN & WAN type of applications. Calculations of Power budgets and feasibility of system design for above optical sources.

Unit IV: Optical Detectors: Introduction & study of type of detectors characteristics. Spectral spread and availability of detectors for 980 nm, 1.3 ìm & 1.55 ìm _ systems. Calculation of detector sensitivity and design considerations of suitable receivers for LAN, WAN applications

Unit V: Multiplexing Components & Techniques : Concepts of WDM, DWDM system design parameters, Optical multiplex / Demultiplex design considerations- Angular dispersive devices, Dielectric thin film filter type devices

Unit VI: Optical fiber measurements:Fiber attenuation measurements, Fiber dispersion measurements, Fiber refractive index profile measurements, fiber cutoff

wavelength measurements, numerical aperture measurements, Fiber diameter measurements

References:

1. "Optical Communication Systems", John Gowar, PHI.
2. "Optical Fiber Communication" Gerd Keiser, MGH.
3. "Optical Fiber Communication Principles & Practice", John M. Senior, PHI pub. 1996.
4. "Data Warehousing", Reema Thareja, Oxford Unviersity Press.
5. "Data Warehousing Fundamentals", Paulraj Ponniah, John Wiley.

1ENTC2 RANDOM PROCESSES

UNIT- I: Probability and Random Variables:

Axioms of probability, Conditional probability, Total probability, Baye's theorem, Concept of random variable, Discrete random variable, Continuous random variable, CDF & PDF, Expectations & Moments, Characteristics functions, Moment generation function.

UNIT - II: Standard Distributions:

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties, Functions of a random variable, Central Limit Theorem (CLT), Generation of random numbers.

UNIT- III: Multi-dimensional Random Variables:

Joint distribution function, Joint density function, Marginal distribution function, Conditional distribution, Covariance & Covariance matrix, Expectations & Moments, Mean and Variance of weighted sum of Random Variables, Joint Gaussian Random Variables.

UNIT- IV: Random Processes and Characterization:

Concept of random process, Characterization and Classification, Gaussian Random Processes. Poision

Process, Wiener Process, Stationery Process, Introduction to White noise, Random Walks, Brownian motion.

UNIT- V Correlation of Random Processes:

Correlation function, Properties of Auto Correlation function, Relationship between two Random Processes, Properties of Cross Correlation function.

UNIT- VI: Power Spectral Density (PSD): -

Concept of Power Spectral Density, Properties of PSD, Power Spectral Estimation, Cross Spectral Density, Power Spectrum in Laplace Domain

References:

1) "Probabilistic Random Signals and Statistics", X Rong Li, CRC Press
2) "Random Signals and Systems", Bernard Picnicbono, PHI.
3) "A First Course in Probability", Shelabo Ross, Pearson Education.

1ENTC3 DIGITAL COMMUNICATION TECHNIQUES

Unit I: Characterization of Communication Signal and Optimum Receiver for AWGN Channel: Signal Space representation, Memory less Modulation methods, Linear Modulation with memory, Non- linear Modulation methods with memory, CPFSK & CPM, Power Spectra of Linear Modulated signal, Power Spectra of CPFSK & CPM Signals, Correlation Demodulator, Match Filter Demodulator, Optimum Detector, Probability of Error for Binary & M-array signals

Unit II: Source Coding: Average mutual information & Entropy, Coding of discrete memory-less sources, Discrete Stationary Sources, Lempel-Ziv algorithm; Coding of analog sources, Rate distortion function, Scalar Quantization & Vector Quantization,

Unit III: Channel Coding: Temporal and Spectral Waveform Coding, BCH codes, Reed Soloman codes, Reed Muller Codes, Convolution Codes, Transfer function of convolution codes, Viterbi decoding algorithm, stack algorithm(No problems expected)., trellis coded modulation.

Unit IV: Signal Design for Band Limited Channel: Design of band limited signal for zero ISI, Nyquist Criterion, Design of band limited signal for controlled ISI, partial response signaling, Data detection for controlled ISI

Unit V: Linear Equalization Techniques : Peak Distortion Criterion, Mean Square Error (MSE) criterion, Decision Feedback Equalization, Coefficient Optimization, Adaptive Linear Equalizer, Zero Forcing Algorithm, LMS Algorithm.

Unit VI: Spread Spectrum Techniques: Generation of PN sequence, direct sequence spread spectrum system, processing gain, jamming margin, application of direct sequence spread spectrum signal, frequency hopped spread spectrum signal, time hopping spread spectrum signal, synchronization of spread spectrum signal – acquisition & tracking.

Text Books:

1. "Digital Communication Fundamentals and Applications", Bernard Sklar, 2nd Ed, Pearson Education Asia
2. "Digital Communication", J.G. Proakis, Fourth Ed, Mc Graw Hill
3. " Error Control Coding: Fundamentals & Applications", Shu Lin & Costell , Addison Wessley Pub.

Reference Books:

1. "Digital Communication Techniques", Simon Haykin, John Wiley & Sons.
2. "Advanced Digital Communication System and Signal Processing Techniques", Dr. Kemilo Feher Prentice Hall International.

1ENTC 4 DIGITAL SIGNAL PROCESSING & APPLICATIONS

Unit-I: Overview of Digital Filters:

Filter specifications, Magnitude & Phase response of digital filter, Linear Phase filters: Type I, Type II, Type III, & Type IV, Analog filter basics: Butterworth, Chebyshev, Inverse Chebyshev filters, Elliptic filters.

Unit -II: Design of Digital FIR filters:

FIR filter design using Fourier Series Method : Low pass, High pass & Band pass filter, FIR design using Hamming, Hanning, Blackman & Kaiser window, Differentiators, Hilbert transforms, Equi-ripple FIR filter design.

Unit -III: Design of Digital IIR filters:

IIR filter design using Impulse Invariance method, Matched Z-transform, Bilinear Transform, Differentiation method (Backward difference method), Design of analog filters: Butterworth, Chebyshev. Frequency transformations in Analog and Digital domain, Finite word length effect in digital filters.

Unit IV: Multi-rate Digital Signal Processing:

Decimation & Interpolation, Linear filtering with decimation and interpolation, Poly-phase filters, Filter banks, sub-band processing, Decimated filter banks, Uniform DFT filter banks, Quadrature mirror filters.

Unit V: DSP Processors and its Application:

Issues involved in DSP processor design, Features of TMS 320C67XX, Architecture of TMS 320C67XX, Memory Organization, Addressing Modes, Pipeline operations, Assembly language instructions, Applications of DSP to Biomedical Signal Processing, Speech signal processing, Radar signal processing.

UNIT VI: Wavelets:

Time-Frequency Analysis and Continuous Wavelet Transform, an introduction to Hilbert Space Theory, Wavelet Properties, Discrete Wavelets, Scaling Function, Subband Coding, Discrete Wavelet Transform.

Text Books:

1. 'Digital Signal Processing Principles, Algorithm and Applications", J. G. Proakis and D.G.Manolakis Fourth Ed Prentice Hall 1997.
2. "A Course in Digital Signal Processing ", Boaz Porat John Wiley & Sons.
3. "Digital Signal Processing", Nagoor Kani, Tata-Mc-Graw-Hill.Publication.
4. "Digital Signal Processors", B. Venkatramani and M. Bhaskar, 2nd Ed., Mc-Graw Hill.
5. "Wavelet Transforms: Introduction to Theory and Applications", Bopardikar and Rao.

Reference Books:

1. "Digital Signal Processing- A Computer based Approach", Sanjit K. Mitra, 4th Ed, Mc- Graw Hill.
2. "Discrete Time Signal Processing : A Practical Approach", E.C. Ifeacher & B.W. Jarvis Pearson Education 3rd Edition.
3. "Digital Signal Processing", Thomas J. Cavicchi, John Wiley
4. "DSP Handbook", Vijay Medisetti & D.B. Williams, CRC Press
5. "Discrete Wavelet Transform', Robi Polikar.
6. "Wavelets and Subband Coding", Valterli & Kovaceric, PHI.
7. "Analog Devices & Texas Instruments", Users Manuel of TMS320C4X and ADSP 2106X.

1ENTC5 ELECTIVE – I

(1) REAL TIME EMBEDDED SYSTEM

Unit I: Embedded System hardware : Embedded systems overview, Hardware components like microcontroller, GPP, ASSP, AISP, SOC, Details of 32 bit ARM**7 core based** SoC architecture, Organisation, analog, digital & high speed I/O for embedded systems, interfacing SRAM, DRAM, flash memories with microcontroller, memory management

Unit II: Embedded System Software : Techniques of writing efficient C code for microcontroller C data types for ARM, Signed & unsigned data types, limitation of char & char & data types, storage class – static & extern, volatile keyword, operation on bits, functions, ARM / Thumb procedural call standard, pointers & arrays, conditional statements – if-else, switch, structure, conditional loops – for & while, preprocessing, compiling, cross compiling, compiler driver, startup code and board support packages, calling assembly routines in C, interrupt handling in C, interrupt latency.

Unit III: ARM Philips NXP LPC2148 Microcontroller: *Programming & Interfacing:*Programming on – chip components like ADC, UART, Timers, External Interrupts and interfacing external peripherals like keyboard, LCD, Stepper motor.

Unit IV: Uniprocessor Real Time Operating Systems – I: Real time systems, goals and services, tasks and its states, task assignment & scheduling, Task Control Blocks, Context & Context Switching, ISRs, Security Issues, inter- task communication, semaphore.

Unit V: Uniprocessor Real Time Operating Systems – II: Task Scheduling models**,** scheduling algorithms – rate monotonic and earliest deadline first, priority inheritance protocol, priority ceiling protocol, real time operating system features, features of micro COS – II RTOS.

Unit VI:Embedded System Architecture & Design : Architecture styles, implementation aspects, estimation modeling, embedded system architecture, validation and debugging of embedded systems, hardware – software co-design in an embedded system

Text Books:

1. "Embedded Systems", Rajkamal, 2nd Edi., Tata Mc-Graw Hill.
2. "Embedded Real-time System Programming", Iyer & Gupta, Tata Mc-Graw Hill.

Reference Books:

1. "ARM System on Chip Architecture", Furber, 2nd Edi Pearson India.
2. "Introduction to Embedded System", K. V. Shibu, MGH.
3. "Philips NXP LPC 2148" user manual
4. "Scheduling in Real Time Systems", Cottet, Delacroix & Mammeri, John Wiley & Son.
5. "Real Time Systems", Rajib Mall, Pearson, India.

1ENTC5 ELECTIVE – I

(2) DATA COMPRESSION

Unit I: Introduction and Mathematical background: Introduction to different compression techniques (Lossless, Lossy, Measure of performance), Modeling and Coding, Physical model, Probability model, Markov model, Composite Source model, Uniquely decodable codes, Prefix codes, Kraft-McMillan inequalityHuffman coding: Minimum variance, optimal, length, Extended Huffman codes, Non-binary Huffman codes, Adaptive Huffman coding, Application of Huffman codes.

Unit II: Arithmetic coding, Dictionary Techniques: Arithmetic coding: Coding a sequence, generating binary codes, Comparison of Huffman and Arithmetic Coding , Adaptive arithmetic coding, Application of arithmetic codingStatic and

adaptive dictionary coding techniques, Repetition Finder, Application related to file compression and Image Compression, V.42 bis Standard, CRC, EXE Compressors, Various LZ Applications

Unit III: Image compression: Context based Compression: Prediction with Partial Match (PPM), Burrows Wheeler Transform, Associative coder. Dynamic Markov CompressionLossless Image Compression: JPEG, JPEG-LS, Run-length coding, facsimile coding standards, progressive Image transmission, Differential Lossless CompressionTransform Coding: K L Transform, DCT, DST, Discrete Walsh-Hadamard transform, Applications of Transform coding to Image and Audio.

Unit IV: Quantization: Scalar Quantization, Quantization problem, Uniform quantization, Adaptive quantization, Non-uniformQuantization, Entropy Coded Quantization. Vector Quantization (VQ): Advantages over Scalar Quantization, The Linde-Buzo-Gray algorithm, Tree Structured Vector Quantization, Structured VQ., Variations on the Theme

Unit V: Sub-band Coding, Wavelets method: Sub band Coding: Filters, Basic Sub-band coding, algorithm, design of Filter Banks, Application to speech coding audio coding and Image compression.Wavelets: Fourier Transform, Frequency Domain, Uncertainty Principle, Fourier Image Compression, CWT and Its Inverse, Haar Transform, Filter Banks, DWT, Multi-resolution Decomposition, Various Image Decompositions, IWT

Unit VI: Audio, Image and Video Compression: Spectral masking, Temporal masking, Psychoacoustic model, MPEG Audio coding, MPEG Advanced Audio coding, Dolby digital. Image Compression : Predictive techniques like PCM, DPCM and DM.Video compression: Video signal representation, H.261 Standard by ITU-T, model based coding MPEG-1 and MPEG- 2 Video Standards, ITU-T H.263 and H.264 Standards, Packet Video

Referencs:

1. "Introduction to Data Compression", Khalid Sayood, 2nd Ed. Academic Press
2. "Data Compression: The complete Reference", David Saloman, 3rd Ed, Springer 2004.
3. "Digital Image Processing", S Jayaraman, S. Esakkirajan, T Veerakumar, Tata Mc-Graw Hill.
4. "Digital Image Processing", R. C.Gonzalez and Woods 3rd Ed, pearson Education

1ENTC5 ELECTIVE – I

(3) ARTIFICIAL INTELLIGENT SYSTEM

Unit I: **Introduction to Fuzzy Set Theory**: Fuzzy set theory, classical set theory, properties of fuzzy sets, operations on fuzzy sets, fuzzy relations, operation on fuzzy relations, extension principle, fuzzy arithmetic membership functions, fuzzification & defuzzification.

Unit II: **Fuzzy Rules, Reasoning & Decision Making**:**Fuzzy reasoning:** introduction, linguistic variables, fuzzy propositions.**Fuzzy rules**: fuzzy rule based system, fuzzy if-then rules, fuzzy inference system. **Fuzzy decision making**: individual, multiperson, multicriterion and multistage decision making fuzzy ranking methods.

Unit III: **Hybrid Systems**:**Fuzzy controller:** construction of FLC, fuzzy PD controller, fuzzy PI controller. **Neuro-fuzzy control:** introduction, inverse learning, specialized learning.**Fuzzy pattern recognition:** introduction, single sample identification, multi-feature recognition.

Unit IV: **rtificial Neural Networks:** Introduction, biological neuron, Artificial neural models, Perceptron Learning rule, Single layer perception, multilayer perceptron network, error back propagation algorithm.

Unit V: **Unsupervised Learning:** Winner-Take-All learning algorithm, hamming net and Maxnet , self organization

feature map, Adaptive Resonance Theory (ART) network, Counter propagation network,**Associative Memories**: Linear associator, Hopfield recurrent associative memory, storage and retrieval algorithm, basic concept of bidirectional associative memory (BAM).

Unit VI: **Support vector machines (SVM):** Optimal hyperplane for linearly separable and non-separable patterns, SVM as a Kernel machine, design of SVM.

Genetic algorithm: Introduction, encoding, fitness function, reproduction, crossover, mutation. Simulated annealing Applications of neural network in character recognition, forecasting, robot kinematics, biomedical signals. Optical neural network

Text Books :

1. “Neural Networks”, S. Hykin ,Pearson Education.
2. “Fuzzy sets and Fuzzy logic Theory and Applications”, George J. Klir, Bo Yuan, PHI
3. “Fuzzy Logic With Engineering Applications”, Timothy Ross, McGraw Hill International.

Reference Books :

1. “Artificial Neural Networks”, Zurada
2. “Neuro Fuzzy and Soft computing”, Jang, Sun, Mezutani
3. “Introduction to Neural networks using MATLAB 6.0”,S.N.Sivanandan, S. Sumathi, S.N. Deepa, McGraw Hill.
4. “Neural networks, Fuzzy logic and genetic algorithms synthesis and applications”, S. Rajasekaran, G.A. Vijayalakshmi Pai, PHI
5. Intelligent Systems & controls, Laxmidhar Behera, Indrani kar (Oxford)

1ENTC5 ELECTIVE – I

(4) CRYPTOGRAPHY AND NETWORK SECURITY

Unit I: **Introduction:** The OSI Security Architecture, Classical Encryption Techniques: Cipher principles, data encryption standard, block cipher design principle and modes of

operation, evolution cryteria for AES, AES cipher – Tripal DES- placement of encryption function- traffic confidentiality.

Unit II: Public Key Cryptography: Key management – Diffie-Hellman key Exchange- Elliptic curve architecture and Cryptography- Introduction to number theory- confidility using symmetric encryption – Public key cryptography and RSA

Unit III:Authentication and HASH function: Authentication requirement- Authentication function -Message Authentication codes, Hash function, Security of Hash function & MACs- MD5 Message Digest Algorithm, Secure Hash Algorithm- RIPEMD- HMAC digital signature-authentication protocol-digital signature standard.

Unit IV: Network Security:- Authentication Applications: Kerberos X.509, Authentication Service.- Electronic Mail Security: Pretty good privacy, S/MIME- IP Security:- web security

Unit V: System Level Security: Instrusion detection-password management- viruses and related threads – virus counter measures - Firewall design principles-Trusted systems.

Unit VI: IP Security: Architecture, Authentifications, Header, Encapsulating Security Payload, Combining security Associations, key Management

Web Security: Web security considerations, System Security:Intruders, Malicious software, Viruses, Viruses and relatedthreats Firewalls: Firewall design principles.

Text Book :

1. "Cryptography And Network Security: Principles and Practices", William stallings, Prentice Hall of India, Third Edition, 2003.

Reference Books :

1. "Cryptography And Network Security", Atul Kahate, Tata McGraw-Hill,2003.

2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons Inc, 2001.
3. "Security in Computing", Charles B. Pfleeger, hari Lawrence Pfleeger, Third Edition, Pearson Education, 2003.

1ENTC6 Lab - I (based on 1ENTC1 & 1ENTC3)

1ENTC7 Lab - II (based on 1ENTC4)

SEMESTER-II

2ENTC1 ADAPTIVE SIGNAL PROCESSING

Unit I : Introduction to Random Signals: Random variables, Sequences and Stochastic Process, Random Signals and Distributions, Averages, Stationary Processes, Special Random signals & its Probability Density Functions (PDF) and its properties, non-parametric spectral estimation, parametric methods of power spectral estimations, Spectra-Correlation Density.

Unit II: Wiener Filters: Input signal and weight vectors, desired response and error, Mean Square Error (MSE), Principle of Orthogonality, FIR Wiener Filters, Wiener Hopf equation, Error performance surface, multiple linear regression model, linearity constrained minimum-variance filter.

Unit III : Adaptive Filtering Algorithms: Eigen values and Eigen Vectors of the correlation matrix, one dimensional gradient search algorithm, Steepest Descent algorithm, LMS algorithm, comparison of the LMS with Steepest Descent Algorithm, Modified LMS algorithm and Examples of LMS algorithm, Normalised LMS filter.

Unit IV : Kalman Filters and Square Root Adaptive Filters: Recursive minimum MSE for Scalar random variables, Kalman filtering problem, Innovation process and estimation of state, Kalman filtering, Square root Kalman filters, QRRLS algorithm.

Unit V : **Recursive Least Square Algorithms:** Linear Least Square Estimation Problem, Introduction to Recursive Least-Squares Adaptive filters, Matrix Inversion Lemma, RLS Algorithm, Convergence analysis of RLS algorithm.

Unit VI :Applications of Adaptive filtering: Adaptive Equalization, noise cancellation, linear prediction, Echo Cancellation, Lattice Filters. System identification, , Inverse modeling, Jammer suppression, Adaptive notch filter, Adaptive feedback cancellation in hearing aids, Foetal monitoring, cancelling of maternal ECG during labour, removal of ocular artifacts from electro-encephalogram by adaptive filtering.

Text Book:

1. "Adaptive Filter Theory", Simon Haykin, 3rd Ed, Prentice Hall Inc, 2002.

Reference Books:

1. "Adaptive Filtering Primer with MATLAB", Alexander D. Poulanikas & Zayed M Ramadan, Taylor & Francis Series, CRS Press.
2. "Adaptive Signal Processing", Bernard Widrow, Prentice-Hall Signal Processing Series.
3. "Real Time Digital Signal Processing : Implementation and Applications", Sen M. Kuo, Bob H. Lee and Wenshun Tian, 2nd Ed, John Wiley & Sons, 2006.
4. "Adaptive Digital Filters", Maurice G Bellanger, 2nd Edition,
5. "Adaptive Nonlinear System Identification", Marcel Dekkar Inc. T Ogunfummi, Springer

2ENTC2 WIRELESS COMMUNICATION

Unit I : **Fundamentals of Wireless Communication :** Evolution of wireless networks and challenges Long term fading models: two ray model, diffraction model, scattering model, Shadow fading Short term fading: Impulse

response of time varying channels, Narrow band fading model, wide band fading models, discrete time model. Capacity of wireless channel, Capacity of AWGN channel, Capacity of flat fading channel, Capacity of frequency selective fading channel, Basic diversity combining techniques.

Unit II : **Analog and Digital Cellular Mobile System:** Analog Cellular System: AMPS, NMT Digital Cellular System: GSM, GSM Architecture, TDMA frame structure, Traffic and Control channels, Voice Processing in GSM. IS -95 (CDMA one): Forward Modulation channel, Reverse Modulation channel.

Unit III: **Wireless Sensor Network:** DARPA efforts toward wireless sensor network, other application of wireless sensor network, Fixed wireless sensor network, wireless sensor networks, sensor deployment, network characteristic, and Design issues in sensor network, Secured communication.

Unit IV: **Low power wireless communication systems, Data Networks and protocols:** Cordless Telephony 2 (CT2), Digital Enhanced Cordless Telephony (DECT), PHS, PDC, PCS (Functional Architecture, Radio Specifications, Frame Structure). Protocols: IEEE 802.11, IEEE 802.15.

Unit V : **Wireless Communication Standards:** Bluetooth: Bluetooth network, Bluetooth Protocol stack, Bluetooth MAC layer , Modified version of Bluetooth.Wi Fi: MAC, security enhancement, WAP, Quality of service enhancements, different version of WiFi standards, EDCA, HCCA, Wimax standard : Wimax physical layer interface, Wimax application in competition with WiFi,Wimax modes, Different versions of Wimax standards, Quality of services of Wimax

Unit VI : Private Mobile Radio network and Introduction to 3G Systems: Private Mobile Radio (PMR): Introduction, user community, requirement of PMR services, PMR configurations, PMR standards, TETRA Network Architecture. IMT 2000: Radio aspects, Network Aspects and Regional initiatives Universal Personal Communication: UPT, Concepts and Service aspects, Functional architecture, Routing, Scenarios for partitioning and location of service information, Access security, Basic concepts of UMTS.

References:

1. "Wireless Networks", G. S. Papadimitriou, A. S Pomportisis, P Nicopolitidis, John Wiley & Sons.
2. "Wireless Communication", Upena Dalal, Oxford.
3. "Introduction toWireless and Mobile System", D.P. Agrawal and Qing-An-Zeng , 3rd edition, Oxford,
4. "Wireless Communication", Andrea Goldsmith, Cambridge University Press.
5. "Mobile and Personal Communication: Systems & Service", Raj Pandya, Prentice Hall India.
6. "Digital Mobile Communication and TETRA Systems", John Dunlop, Demessie Girma, James Irvine, John Wiley & Sons.
7. "Wireless communications: Principles and Practice", Theodore S. Rappaport, P.E.
8. "Principles of Mobile Communication", Gordon L Stuber, 2nd Ed, Kluwer Academic Publishers
9. "Mobile Cellular Telecommunication", William C Y Lee , Mc Graw Hill

2ENTC3 ADVANCED COMPUTER NETWORKS AND PROGRAMMING

Unit I: Review of computer networking: ISO-OSI reference model, Point to point Protocol, ARQ techniques, Data network switching techniques.

Unit II: TCP/IP: TCP/IP architecture, TCP Segments, TCP flow control, IPv4 versus IPv6, UDP, Fragmentation, ARP & RARP , ICMP,IGMP, DHCP, Mobile IP, UnIcast and Multicast Routing protocols.

Unit III: Network management: Delay models in data networks, Performance measures & architecturalIssues, Queuing Model (M/M/1, M/M/C, and M/G/1), Network management and congestion control algorithm.

Unit IV: ATM Networks: Need for ATM, B-ISDN reference model, ATM Layers, ATM adaptation Layers, ATM Signalling, PNNI routing, QoS in ATM.

Unit V: Advance Network Architecture: Overlay model, MPLS, Integrated services, Differentiated services, RSVP.

Unit VI: Network Security: Ciphers, DES, public key cryptography, RSA algorithm, Digital water marking, Attack and counter measure.

Text Books :

1. "Communication Networks", Leon Garcia & Wadeja, Tata McGraw Hill Publication.
2. "Data and Computer Communication", William stallings, 8th edition, Pearson Education

Reference Books :

1. “Data Networks” Dimitri Bertisekas & Robert Gallager, PHI.
2. “Local Area Networks”, Gerd E Kieser, Mc-Graw-Hill.
3. “Cryptography and Network Security: Principles and Practice”, William Stallings, Pearson Education.
4. "TCP/IP Protocol Suite", Behrouz Furozan, Mc Graw Hill

2ENTC4 RF AND MICROWAVE CIRCUIT DESIGN

Unit I: Two Port RF Networks-Circuit Refrigeration: Low frequency parameters-impedance, admittance, hybrid and ABCD. High frequency parameters-Formulation of

Sparameters, properties of S parameters-Reciprocal andlossless networks, transmission matrix, Signal Flow Graph:

Unit II: **Matching and Biasing Network:** Impedance matching networks, impedance matching using discrete components, frequency response, T and Π matching networks, microstripline matching networks (unilateral/ bilateral), single stub matching networks, double stub matching networks

Unit III: **RF Transistor Amplifier Design:** Characterstics of Amplifier, Amplifier power relation, stability considerations, constant gain, Noise figure circles, constant VSWR circles, broadband, high power and multistage amplifiers.

Unit IV: **Design of Ooscilators and Mixsers:** Basic oscillator model, negative resistance oscillator, feedback oscillator design, design steps, quarts oscillator, high frequency oscillator configuration, fixed frequency oscillator, voltage controlled oscillator, gunn element oscillator, basic characterstics of mixer, frequency domain considerations, single ended mixer design, single and double balanced mixer.

Unit V: **Introduction to Microwave Integrated Circuits:** Introduction to MIC'S and their technology, components for MIC'S, stripline, general stripline characterstics, modes on stripline, hybrid mode analysis, losses in microstrip, Introduction to coupled Microstrip, Even and odd mode analysis, Directional couplers, branch line couplers,

Unit VI: **MMIC Technology :** Introduction to MMIC, substrates and technologies, passive components, Fabrication process of MMIC, thick and thin film technology, Testing methods, Encapsulation and mounting of Devices.

References:

1. "Microwave Devices & Circuits", Samuel Y Liao, Prentice Hall of India, 2006.
2. "RF Circuit Design", Reinhold.Ludwig and Pavel Bretshko Pearson Education, Inc., 2006
3. "RF & Microwave Electronics Illustrated", M.M.Radmanesh , Pearson Education, 2007.
4. "HandBook of Microwave Intergrated Circuits",, Hoffman R.K.Artech House,Boston,1987.
5. "Microwave Intergrated Circuits", Gupta .K.C and Amarjit Singh, John Wiley,New York,1975.

2ENTC5 ELECTIVE-II
(1) MOBILE COMPUTING

Unit – I: **Wireless network technology:** Introduction to 3G and 4G mobile systems. Global System for Mobile Communication (GSM) , Wireless media access control protocols; Wireless LAN, TDMA, PRMA, CDMA, WCDMA.

Unit – II: **Channel allocation and interference reduction:**Static and Dynamic channel allocation, Fixed channel allocation, centralized and distributed dynamic channel allocation, hybrid channel allocation, flexible channel allocation schemes, allocation in specialized system structure, channel allocation in one dimension system, Reuse partitioning based channel allocation, overlapped cell based channel allocation.Co channel interference, Real time co channel interference measurement, Design of omni directional antenna system in worst case, lowering the antenna system, reduction in co channel interference, umbrella pattern effect, power control, Adjacent channel interference, Near END Far End interference, cross talk, UHF TV interference, long distance interference.

Unit III: **Mobility and Location management:** Introduction, cell admission control, handoff management, Location management for mobile network, Two- Tiered architecture, SS& network and common channel signalling, location update, cell setup and paging, location management for PCS network Traffic calculation: system and traffic parameter, handoff rate calculation.

UnitIV: **Mobile Protocol:** Mobile medium access control protocol, Mobile Internet Protocol, Evolution of mobile IP, working of mobile IP, Packet delivery and handover management, registration, Tunnelling and encapsulation, Routing optimization, Indirect TCP, Snooping TCP, Mobile TCP, TCP Reno, New TCP Reno, Multicast for mobility protocol, Mobicast, RMDP protocol, RM-2 protocol.

Unit V: **Services in wireless networks:** Quality of service, Delays, error and packet loss, Error control schemes, Mobile distributed application support: Operating system support, Mobile middleware and object architecture, Mobile transaction, Remote execution and mobile RPC, Cache strategies for wireless networks.

Unit VI: **Security issues in mobile and wireless:** Traditional Security Issues, Mobile and Wireless Security Issues, Additional Issues(Liability, Fear, uncertainty and doubt, Fraud, Big bucks at stake), Additional Types of Attacks(man in the middle attacks, traffic analysis, Replay attacks, Buffer overflow attacks)Approaches to security: Limit the signal, Encryption, Integrity codes, Ip security, Other Security related Mechanism(Authentication protocols, AAA, Special Hardware)

References:

1. "Mobile Computing", T. Imielinski and H.F. Korth, Kluwer Academic

2. "Wireless Communication and Networking", Jon.W. Mark, Weihau Zhuang, Prentice Hall of India Private Limited
3. "Mobile Computing", Rajkamal, Oxford
4. "Fundamental of Mobile Pervasive Computing", Frank Adelstein, Sandeep K S Gupta Tata. MC. Graw Hill Publishing company limited
5. "Wireless and Cellular Tele Communication", Willium. C. Y. Lee, MC Graw Hill
6. "Introduction toWireless and Mobile System", D.P. Agrawal and Qing-An-Zeng , 3rd edition, Oxford,
7. "Mobile Computing", Asok Talukdar, Roopa Yawagal, TMH

2ENTC5 ELECTIVE-II
(2) COMMUNICATION SYSTEM DESIGN

Unit I: Designers perspective of communication system: Wireless channel description, path loss, multi path fading Communication concepts, Receiver Architectures: Introduction, Overview of Modulation Schemes, Classical Channel, Wireless Channel Description

Unit II: Path Losses: Detailed Discussion. Multipath Fading: Channel model and Envelope Fading, Multipath Fading: Frequency Selective and Fast Fading, Summary of Standard Translation

Unit III: Introduction Receiver Architectures, Receiver front End: general discussion, Filter Design, rest of Receiver Front Eng: Non ideatlites and Design Parameters, Derivation of NF, IIP3 of Receiver Front End, Partitioning of required NFrec_front and IIP3,rec_front into individual.

Unit IV: Low Noise Amplifier: Introduction, Wideband LNA, Design, Narrow band LNA: Impedance Matching, Narrowband LNA: Core Amplifier, Active Mixer: Introduction, Balancing, Qualitative Description of The Gilbert Mixer, Conversion Gain, Distortion, Low-

Frequency Case: Analysis of Gilbert Mixer, Distortion, High- Frequency Case, Noise, A Complete Active Mixer, References, Problems

Unit V: Analog to Digital Converters: Demodulators, A to D Converters used in receivers, Low cost Sigma delta modulators and it's implementation,

Unit VI: Design Technology for Wireless Systems: Design entry / simulation, Validation and analysis Tools.

References:

1. "VLSI for Wireless Communication", Bosco Leuing, PE.
2. "The Design of CMOS Radio Frequency Integrated Circuits", T Lee, Cambridge University Press.
3. "Analysis and Design of Analog Integrated Circuits", P Gray and R Meyer, John Wiley & Sons.
4. "Microelectronics Transistor Amplifier, Analysis and Design", G Gonzalez, Prentice Hall.

2ENTC5 ELECTIVE-II

(3) OPTICAL NETWORKS

Unit I: **SONET & SDH :** Brief history of SONET & SDH, Multiplexing hierarchy, Multiplexing structure, Frame structure, Functional components, Problem detection, Virtual tributaries & Virtual containers, Concatenation.

Unit II: **Architecture of OTN:** Digital wrapper, control planes, In-band and out of band Control signalling, Current digital transport hierarchy, SONET and SDH Multiplexing hierarchies, revised hierarchies, Optical & Digital Transport hierarchies, OTN Layered model, Encapsulation & De-capsulation, GFP.

Unit III: **WDM, DWDM Topologies:** Relationship with SONET / SDH, EDF, WDM Amplifiers, Add-Drop Multiplexers, Span loss & chromatic dispersion,

Network Topologies & Protection schemes: Non-negotiable requirements of robust networks, Line & Path protection switching, Type of Topologies, Optical Channel Concatenation, Meshed topologies, PON's, Optical Ethernets, Wide area Backbones, Metro optical networking.

Unit IV: **MPLS & Optical Networks:** Label switching, FEC, Scalability & granuility: labels & wavelength, MPLS nodes, Distribution & Binding methods, MPLS support of virtual private networks, Traffic Engineering, MPLS, Relationships of OXC, MPLS operation, MPLS & optical Traffic Engineering, Similarities. Control & Data-planes interworking,

Unit V: **Architecture of IP & MPLS based optical transport Networks :** IP, MPLS & Optical control planes-Interworking, The three control planes, Framework for IP Vs. Optical networks, Generalized MPLS use in optical networks, Bidirectional LSP's in optical network, Next horizon of GMPLS, ODVK General communication channels, Traffic parameters

Unit VI: **Link Management Protocol (LMP):** Basic function of LMP, LMP messages, LMP message header, Control channel management, Optical Routers: Evolution of switching technologies, Speeds of electronics & photonics, Optical routers, Control element, switching technologies MEMS, Label switched paths (LSP) and OSP, Setting up LSP and OSP, protection paths between nodes, Recovery and use of protection path.

References:

1. "Optical Networks: Third Generation Transport System",Uyless Black, Prentice Hall.
2. "Opto Electronic Computing System", Jordan

2ENTC5 ELECTIVE-II
(4) SPEECH & AUDIO PROCESSING

Unit I: **Digital models for the Speech Signal:** Process of speech production, Acoustic theory of speech production, Lossless tube models, an Digital models for speech signals. Time domain models for speech processing: Time dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using energy & zero crossings, Pitch period estimation, Short time Autocorrelation function, Short time average magnitude difference function, Pitch period Estimation using autocorrelation function, Median smoothing.

Unit II: **Homomorphic speech processing:** Homomorphic systems for convolution, Complex cepstrum, Pitch detection, Formant estimation, Homomorphic vocoder. Linear predictive coding of speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters.

Unit III: **Speech Synthesis:** Spectral subtraction & filtering, Harmonic filtering, parametric re-synthesis, Adaptive noise cancellation. Speech Synthesis: Principles of speech synthesis, Synthesizer methods, Synthesis of intonation, Speech synthesis for different speakers, Speech synthesis in other languages, Evaluation, Practical speech synthesis.

Unit IV: **Automatic Speech Recognition:** Introduction, Speech recognition vs. Speaker recognition, Signal processing and analysis methods, Pattern comparison techniques, Hidden Markov Models, Artificial Neural Networks.

UnitV : **Audio Processing:** Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio

Unit VI: **Audio Coding:** High quality, lowbit- rate audio coding standards, MPEG, AC-3, Multichannel audio - Stereo, 3D binaural and Multichannel surround sound.

Text Books:

1. "Digital Processing of Speech Signals", L. R. Rabiner and R. W. Schafer, Pearson Education (Asia) Pvt. Ltd., 2004.
2. "Speech Communications: Human and Machine", D. O'Shaughnessy, Universities Press, 2001.
3. "Fundamentals of Speech Recognition", L. R. Rabiner and B. Juang, Pearson Education (Asia) Pve. Ltd., 2004.
4. "Fundamentals of Multimedia", Z. Li and M.S. Drew, Pearson Education (Asia) Pvt. Ltd., 2004.

Reference Books:

1. "Speech Recognition: Theory & C++ Implementation", C. Becchetti & L. P. Ricotti, John Wiley & Sons.
2. "Speech Communication: Human & Machine", D. O' Shaughnessy, Universities Press.
3. "Speech & Audio Signal Processing",, B. Gold & N. Morgan, John Wiley & Sons.