Post-Graduate programme

M.Tech.(Digital Communications)

Rules, Regulations, Scheme of Instruction & Evaluation and Syllabi
with effect from

2010-2011

BOARD OF STUDIES
IN
ELECTRONICS & INSTRUMENTATION ENGINEERING
KAKATIYA UNIVERSITY
WARANGAL-506009

July, 2010

KAKATIYA UNIVERSITY, WARANGAL-506009
RULES AND REGULATIONS FOR FOUR SEMESTER
M.TECH. DEGREE PROGRAMME
(w.e.f. 2010-2011)

1.0 MINIMUM QUALIFICATION FOR ADMISSION

1.0.1 For GATE candidates

The candidates should have passed BE/B.Tech./AMIE in ECE, AMIE(Electronics & Telecommunication Engg.)/AMIETE and Electronics Telematics Engg. B.E./B.Tech. Degree in Electrical or Electrical & Electronics Engineering, EIE and Bio-Medical Engineering or equivalent. They should have qualified at the GATE and possess a valid GATE score. The seats will be assigned purely on the basis of merit of GATE.

1.0.2 For Sponsored seats

The candidates should have passed BE/B.Tech./AMIE in ECE, AMIE(Electronics & Telecommunication Engg.)/AMIETE and Electronics Telematics Engg. B.E./B.Tech. Degree in Electrical or Electrical & Electronics Engineering, EIE and Bio-Medical Engineering or equivalent.

The criterion for selection of sponsored candidates shall be by their merit at the entrance examination to be conducted by the PGECET

- Admission shall made into sponsored category only with the candidates who are qualified either GATE/ PGECET or as decided by the admission committee.
- His/ Her application shall be duly recommended by the sponsoring agency for admission to the course and forwarded to the Convener, PGECET
- He/ She must be permanent employee with the sponsoring agency for at least two years, after obtaining the qualifying degree.
- The sponsoring agency must be a Government establishment or a public-sector undertaking, or a reputed private engineering college
- The sponsoring agency shall certify that the candidates will be granted leave for pursuing the M.E./ M.Tech. Regular course of study.
- The candidates who are working Research Projects approved by the competent authority are also required to fulfill the above conditions before they are sponsored for admission

2.0 CONFERMENT OF THE DEGREE

The degree of Master of Technology in a specified Branch of Engineering will be conferred on a candidate who has fulfilled the following conditions.

2.0.1 The candidate, after admission to the first year of the two year M.Tech. Program, has to pursue a regular course of study for two academic years and

2.0.2 The candidate must have satisfied the academic requirements of the specified field of specialization in each semester / year herein after prescribed.

3.0 THE PROGRAMMES OF STUDY

The programs of study prescribed for the degree of Master of Technology shall provide for specialization in the following branch.

3.0.1 Electronics & Instrumentation Engineering with specialization in Digital Communications.

4.0 REGULAR PROGRAMME OF STUDY

A candidate will be deemed to have pursued a regular program of study as a full time student provided he/she satisfied the following condition:

4.0.1. The candidate must not have enrolled as a student in any other degree or diploma program recognized by the Government or Kakatiya University.

5.0 ATTENDANCE REQUIREMENTS

5.0.1 Attendance requirements of a semester shall be deemed to have been satisfied provided:

5.0.1.1 The candidate puts in a minimum attendance of 75 per cent in each course of instruction prescribed for the semester.

5.0.2. A candidate, who failed to satisfy the above requirements of attendance shall be detained and will not be permitted to appear at the University examinations. A maximum of 10% of attendance can be condoned, on medical grounds, by the Vice-Chancellor of Kakatiya University with a prior intimation for all the courses of that semester.

6.0 DURATION OF A SEMESTER

6.0.1 Each semester of the M.Tech. degree Programme shall consist of 18 weeks of instruction, including the period of mid-session tests and the University examinations.

6.0.2 Third semester of the M.Tech. degree program shall consist of 8 weeks of Industrial Training followed by 18 weeks of dissertation work.

6.0.3 Fourth Semester of M.Tech. degree shall consist of 24 weeks of Dissertation work.

7.0 REGISTRATION

7.0.1 All the students are required to get themselves registered for the course work by paying the prescribed tuition fee before the start of course work of each semester failing which they shall not be allowed to attend the course work prescribed for that semester.

7.0.2 Candidates detained due to shortage of attendance are to register within 7 days of commencement of semester failing which they shall not be allowed to attend the course work prescribed for that semester with the approval of Kakatiya University.

7.0.3 Registration shall be the sole responsibility of the student.

8.0 EVALUATION

8.0.1 The performance of the student in every semester thereafter shall be evaluated course-wise as detailed in the scheme of instruction and evaluation.

8.0.2 The pattern of allocation of marks for University Examinations and sessional work shall be the following.

8.0.2.1 Theory courses:

University Examinations	100
Internal Examination	50

8.0.2.2 Laboratory/Seminar/Comprehensive Viva/ Project Work

	Lab	**Seminar**	**Comprehensive Viva-voce**	**Project Work**
University Examinations	50	--	100	200
Internal Examinations (by Continuous Evaluation)	50	100	--	100

8.0.3 Internal evaluation of theory courses in each of the semesters shall be based on two mid-session tests of two hours duration. Best of the two tests shall be considered for the award of Internal marks.

8.0.4 For the elective course the department has the “choice” not to offier the elective course if five or less than students only have opted for the course.

8.0.5 Guidelines for Evaluating Laboratory Classes:

The evaluation of Laboratory classes should be divided in to two major components namely, Evaluation on a continued basis and end semester test.

Component 1: (Evaluation on continued basis)
It is recommended to allocate 35 marks to this component. These marks are to be awarded for every experiment carried out by the student in his/her regular practical class on weekly basis.

Component 1.1: Experiment (20 marks)
The student is required to write the principle, theory and calculation method of the experiment allotted to him either in the observation notebook or on a separate sheet immediately after entering the laboratory. At the end of the experiment the student should show the observations and the result to the teacher. The marks of this sub-component are to be awarded taking all the points mentioned above into consideration.

Component 1.2 : Submission of Record Book (15 marks)
The student has to submit the practical record book updated every week. The teacher has to ask a few viva questions based on the experiment carried out by the student in the previous class. The marks awarded in this sub-component should be reduced depending on the extent of delay in the submission of record book.

The marks of component 1.1 & component 1.2 are to be entered separately by the staff members in students attendance registers regularly.

Component 2: (Evaluation at the end of the semester): (15 Marks)
An internal assessment laboratory test and the viva-voce are to be conducted at the end of the semester.

8.0.6 Guidelines for Seminar:

8.0.6.1 The Students of M.Tech. I semester are to register a relevant topic with in 4 weeks of commencement of semester class work and submit the same to the department.

8.0.6.2 Evaluation of seminar consists of two components namely Report (50 marks) and Presentation (50 marks)

8.0.6.2.1 Report: Students are required to submit a report on the chosen seminar topic as per the prescribed format and last date specified by the Departmental Post Graduate Review Committee (DPGRC)

8.0.6.2 Presentation: The students are required to deliver the seminar before the DPGRC as per the schedule notified by the department.

DPGRC will decide the course of action on the students who fail to submit the report and present the seminar.

8.0.7 Guidelines for Industrial Training:

8.0.7.1 M.Tech. Coordinator in consultation with the Training & Placement section has to procure training-cum-dissertation slots, for the students before the last day of instruction of II semester.

8.0.7.2 The students are to confirm their training slot by the last day of II semester.

8.0.7.3 The students after 8 weeks of Industrial Training shall submit a certificate, a report in prescribed format before the last date specified by the DPGRC.

The DPGRC will decide the course of action on the students who fail to submit the training certificate and report.

8.0.8 Guidelines for Dissertation:

The **Department Post-Graduate Review committee** is to be constituted with 5 members i.e. Chairman – Head of the Department, Convenor – M.Tech. Coordinator and 3 other faculty members including supervisor.

The committee is to evaluate the progress of the Dissertation conducting 2 presentations in third semester and monthly presentations in fourth semester.

III – Semester **Total Marks – 100**

50 marks for presentations
50 marks for regular evaluation by supervisor.

1st presentation (Registration Seminar) after 6 weeks from the commencement of the semester for 25 marks – **Registration Seminar:** Project proposal (problem specification, expected out come)

2nd presentation (Progress Seminar) after 12 weeks from the commencement of the semester for 25 marks - Progress **Seminar:** Status of the dissertation – work already carried out, balance of work to be carried out; Progress seminars are to be delivered between 1st and 5th of every month.

IV – Semester **Total Marks – 200**

Synopsis Seminar: Together with synopsis a presentation to be made and the dissertation should be demonstrated two weeks before the submission date.

Supervisors are to evaluate the Dissertation regularly, based on the progress report submitted by the students every week and the same should be recorded.

Project work will be carried out in III and IV semesters under the supervision of a faculty member from within the respective department. Students may be permitted to work under the joint guidance of two members of the faculty – in which case, one of the guides may be from an allied department.

A student may, however, be permitted by the Head of the Department concerned to work on a project in an Industrial / Research organization, in the project semesters. In such case, the faculty guiding the student shall be called the internal guide and the scientist / manager guiding, the student (at site) shall be called the external guide.

No student will be allowed to submit the project report before 48 weeks and after 52 weeks from commencement of III semester.

The DPGRC will decide the course of action on the students who fail to submit the dissertation.

8.0.9 <u>Guidelines for Comprehensive Viva-voce:</u>

Comprehensive Viva-voce examination would be conducted with both Internal and External Examiners as panel members immediately after the end of II semester along with the other Laboratory Examinations. It would be evaluate for 100 marks. All the members of the faculty should also be present for the same.

9.0 MINIMUM REQUIREMENTS FOR PASSING A COURSE:

9.0.1 A candidate shall be deemed to have passed in a course if he/she secured 40 percent of the marks assigned to the University examination of the course, and

9.0.2 40 percent of the marks assigned to the sessionals and University examination of the course taken together.

10.0 EXAMINATIONS

10.0.1 Examinations for each semester will be conducted once in an academic year.

10.0.2 A candidate who failed in a course (theory or practical) can appear at a subsequent University examination in the same course. However, the sessional marks secured by the candidate in that course during the semester of study shall remain unaltered.

10.0.3 Any candidate appearing for examinations in any subject, after two years from his admission will be governed by the syllabus in force.

11.0 ELIGIBILITY FOR AWARD OF DEGREE

11.0.1 A candidate shall be deemed to have satisfied the requirements for the award of the M.Tech. degree provided he/she passes in all the courses including dissertation prescribed in the scheme of instruction within a period of four consecutive years from the year of admission to the Programme.

11.0.2 A candidate who fails to fulfil all the requirements for the award of M.Tech. degree in a period of four consecutive academic years from the year of his/her admission to the M.Tech. degree Programme shall forfeit his/her enrolment to the Programme.

11.0.3 A candidate who is permitted to discontinue may rejoin the course at the appropriate semester only along with the regular students at the time of normal commencement of that semester.

11.0.4 A candidate who discontinues and rejoins shall be governed by the rules, regulations, courses of study and syllabus in force, at the time of his/ her rejoining the course.

11.0.5 A student may be permitted by the Head of the Institute to withdraw from the programme for a year, for reasons of ill-health or other valid reasons on the recommendation of the Head of the Department. Such student who discontinues and rejoins shall be governed by the rules, regulations, courses of study and syllabus in force, at the time of his/ her rejoining the course.

12.0 AWARD OF DIVISION

Division is awarded as follows: Based on the marks weighted by credits

First Class with Distinction:
Single attempt in every exam & securing 70% or more in aggregate.

First Class:
Securing 60% or more in aggregate provided the candidate passes all the papers within four years, the maximum period allowed for obtaining the degree.

Second Class:
Securing less than 60% and more than 40% in aggregate.

The student on successful completion of his course, transcript shall be awarded on the basis of Credit systems. The details are as follows.

- For I Semester .. 27 Credits
- For II Semester .. 27 Credits
- For III Semester .. 2 Credits
- For IV Semester .. 8 Credits

13.0 GENERAL

13.0.1 The award of degree to a candidate shall be withheld if:-

13.0.1.1 He/she has not cleared dues to the institution / Hostel and/or
13.0.1.2 A case of disciplinary action is pending against him/her

13.0.2 The marks secured in sessional evaluation and University examinations shall be shown separately in the marks sheet.

13.0.3 Whenever ambiguities arise in interpreting the regulations, the Standing Committee of Kakatiya University shall have the power to make rules or to issue clarifications for removing such ambiguities.

13.0.4 The Academic Regulations should be read as a whole for purposes of any interpretation.

13.0.4.1 These academic regulations shall come into force from the year 2010-2011 for the batches of students who will be admitted in 2010-2011 and subsequent academic years.

13.0.5 The Total duration for the course shall normally be 24 calendar months. No course shall commence more than once in an academic year.

13.0.6 A candidate shall have to appear in overall comprehensive Viva-voce examinations as laid down in the schemes of instruction and evaluation.

13.0.7 A candidate who has completed the course work of two-semester shall be required to register in third semester of Master of Technology to the dissertation and defend it through oral Examination after the fourth semester.

13.0.8 A candidate who fails in the oral examination for dissertation shall have to defend it again as per recommendation of the Departmental Post-Graduate Review Committee.

13.0.9 For evaluation of each theory examination there shall be two examiners, one from Kakatiya University and another from outside Kakatiya University. Theory papers evaluated in such manner shall be subjected to moderation as per the norms of the Kakatiya University.

For laboratory examination there shall be two examiners, one from Kakatiya University (internal examiner) and another from outside Kakatiya University (external examiner). In case the external examiner does not turn up, another internal examiner appointed by Chief Supdt. of Exams will conduct exam as per schedule.

13.0.10 An examination board will be set up for comprehensive Viva-voce for M.Tech. course as per scheme of instruction and evaluation. The Boards shall consist of the following.

(i) Four internal faculty including the Chairman of DPGRC and

(ii) One external examiner.

The Chairman, DPGRC and the external examiner will award marks.

13.0.11 For each dissertation examination there shall be a panel of examiners consisting of one supervisor and one external examiner.

13.0.12 Every student has to under go Industrial Training for 8 weeks after second semester course work. However the students who are from industry/organization are exempted from undergoing industrial Training.

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KAKATIYA UNIVERSITY,WARANGAL

The course structure and scheme of Evaluation (Semester wise) for the Post-Graduate programme

M.TECH. (DIGITAL COMMUNICATIONS)

SEMESTER-I

Course Code	Name of the course	Periods per week		Sessionals		End Semester Examination		Total	Credits
		Lectures	Practicals	Time (Hrs)	Max. Marks	Time (Hrs)	Max Marks		
MTDC 11	Detection & Estimation Theory	4	-	2	50	3	100	150	4
MTDC 12	Data & Computer Communications (DCC)	3	-	2	50	3	100	150	3
MTDC 13	Advanced Digital Signal Processing (ADSP)	3	-	2	50	3	100	150	3
MTDC 14	Microwave & Optical Fiber Communication Systems	3	-	2	50	3	100	150	3
MTDC 15	Data Compression Techniques (DCT)	3	-	2	50	3	100	150	3
MTDC 16	Elective-I	3	-	2	50	3	100	150	3
MTDC 17	Seminar	-	3	Report & Presentation	100	-	-	100	4
MTDC 18	Digital Communications Lab	-	3	-	50	3	50	100	2
MTDC 19	Microwave & Optical Fiber Communication Systems Lab	-	3	-	50	3	50	100	2
	Total	**19**	**7**		**500**		**700**	**1200**	**27**

MTDC 16 - Elective-I:

(a) Advanced Digital Design (ADD)
(b) Artificial Neural Networks (ANN)
(c) Embedded System Design(ESD)
(d) Low Power VLSI(LPVLSI)

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The course structure and scheme of Evaluation (Semester wise) for the Post-Graduate programme

M.TECH. (DIGITAL COMMUNICATIONS)

SEMESTER-II

Course Code	Name of the course	Periods per week		Sessionals		End Semester Examination		Total	Credits
		Lectures	Practicals	Time (Hrs)	Max. Marks	Time (Hrs)	Max Marks		
MTDC 21	Coding Theory(CT)	3	-	2	50	3	100	150	3
MTDC 22	Communication System Modeling (CSM)	3	-	2	50	3	100	150	3
MTDC 23	Multimedia Communications & System Design (MCSD)	3	-	2	50	3	100	150	3
MTDC 24	Digital Image Processing (DIP)	3	-	2	50	3	100	150	3
MTDC 25	Elective-II	3	-	2	50	3	100	150	3
MTDC 26	Elective-III	3	-	2	50	3	100	150	3
MTDC 27	Advanced Digital Signal Processing Lab	-	3	-	50	3	50	100	2
MTDC 28	Communication System Modeling & Simulation Lab	-	3	-	50	3	50	100	2
MTDC 29	Comprehensive Viva Voce	-	-	-	-	-	100	100	5
	Total	**18**	**6**		**400**	**-**	**800**	**1200**	**27**

MTDC 25 - Elective-II:

(a) DSP Processors
(b) Satellite Communications
(c) Radar Signal Processing
(d) Radio Navigational Aids

MTDC 26 - Elective-III:

(a) Adaptive Signal Processing
(b) Wireless & Mobile Communications
(c) Adhoc & Wireless Sensor Networks
(d) Quantum Communications

KAKATIYA UNIVERSITY, WARANGAL

The course structure and scheme of Evaluation (Semester wise) for the Post-Graduate programme

M.TECH. (DIGITAL COMMUNICATIONS)

SEMESTER-III

Course Code	Name of the Course	Duration	Sessionals	End semester examination	Total	Credits
MTDC 31	Industrial training	8 weeks	**Report Submission**		**Satisfactory/ Not satisfactory**	
MTDC 32	Dissertation	18 weeks	**100**	**--**	**100**	**2**

SEMESTER-IV

Course Code	Name of the Course	Duration	Sessionals	End semester examination	Total	Credits
MTDC 41	Dissertation	24 weeks	**100**	**100**	**200**	**8**

MTDC 11 DETECTION & ESTIMATION THEORY

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Introduction, Simple Binary Hypothesis Tests, M-Hypothesis, Estimation Theory, Composite Hypothesis, General Gaussian Problem, Performance Bounds and Approximations, Sampling of Bandlimited Random Signals, Periodic random Processes, Spetral Decomposition, Vector Random Process.

UNIT-II

Detection & Estimation of Signals in white Gaussian Noise and Non-White Gaussian Noise, Signals with unwanted Parameters, Multiple channels and Multiple Parameter, Linear & Non-Linear estimates, MLP & ML Estimates, Maximum Likelihood Estimate of Parameters of Linear Systems.

UNIT-III

Minimum probability error ciriterion, Neyman-pearson criterion for radar detection of constant and variable amplitude signals, Matched filters, optimum formulation, Detection of Random signals, simple problems there on with Multisample cases.

UNIT-IV

Estimation of Continuous wave forms: Derivation of Estimator Equations, A Lower Bound on the Mean square Estimation error, Multi dimensional wveform estimation, Nonrandom wave from estimation.

UNIT-V

Estimation of Time varying signals – Kalman Filtering, Filtering Signals in Noise treatment, Restricted to two variable case only – Simple problem, realizable Linear Filters, Kalman Bucy Filters, Fundamental role of Optimum Linear Filters.

TEXT BOOKS:

1. Detection, Estimation and Modulation Theory: Part-1-Harry L.Van Trees, 2001, John Wiley & Sons, USA.
2. Signals Processing: Discrete Spectral Analysis – Detection & Estimation – Mischa Schwartz, Leonard Shaw, 1975, Mc GrawHill.

REFERENCES:

1. Fundamentals of Statistical signal processing: volume I Estimation Theory – Steven.M.Kay Prentice Hall, USA, 1998.
2. Fundamentals of Statistical Signal Processing: Volume I Detection Theory-Steven.M.Kay, Prentice Hall, USA, 1998.
3. Introduction to statistical Signal Processing with Applications-Srinath, Rajasekaran,Viswanathan, 2003,PHI.
4. Statistical Signal Processing: Detection, Estimation and Time Series Analysis – LouisL.Scharf, 1991, Addison Wesley.
5. Random Ssignals: Detection, Estimation and Data Analysis – K.Sam Shanmugam, Arthur m.Breiphol, 1998, John Wiley & Sons.

MTDC 12 DATA & COMPUTER COMMUNICATIONS

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Base Band Data Transmission: Duo-binary system, M-ary signaling schemes and equalization.

Band Pass Data Transmission: Coherent and Non-coherent detection of binary signals: MSK and QPSK signaling scheme generation and detection.

UNIT-II

Fading: Digital Signaling over multi path fading channels, characterization of time varying frequency selective channels, binary signaling over frequency non-selective fading channel.

Spread Spectrum Techniques: Overview of DS spread spectrum systems, FH systems, synchronization, Jamming considerations.

UNIT-III

Data Communication Networking: Computer communication architecture, Data link control line configuration, flow control, error control, bit-oriented link control (HDLC).

Communication Networking Techniques: circuit, message and packet switching, broadcast networks, packet switching: Virtual circuits and datagrams, routing, Traffic control, error control.

UNIT-IV

Radio and Satellite Networks: Packet radio architecture, access protocols, satellite network architecture, channel access protocols, local networks: technology Bus/Tree topology, ring topology, medium access control protocols and protocol performance.

Reference Text Books

1. John.G.Proakis, *Digital Communication*, MGH 4th edition, 2001
2. Sklar, *Digital Communication*, Pearson Education 2nd Edition, 2002
3. K.S.Shanmugan, *Digital and Analog Communication Systems*, Wiley, 1985
4. J.Das, SKMullick, PK Chatterjee, *Principles of Digital Communication*, Wiley eastern,1992
5. Stallings W, *Data and computer communications*, Maxwell Mac Mllan, Peasrosn Education, 2002
6. Andrew S.Tanenbaum, *Computer Networks*, PHI, 4th Edition,
7. Green, *Computer Networks architectures and protocols*, Plenum, Pearson Education, 1983.

MTDC 13 ADVANCED DIGITAL SIGNAL PROCESSING

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Multirate Digital Signal Processing: Decimation, Interpolation, time domain and frequency domain characterization of sampling rate alteration devices, Fractional sampling rate conversion, Direct-form FIR structures, poly phase filter structures, Time-variant filter structures, multistage implementation of sampling rate conversion, design of phase shifters,

Interfacing of digital system: Interfacing with different sampling rates, Implementation of digital filter banks, sub band coding of speech signals, quadrature mirror filters, Trans multiplexers, oversampling ADCs and DACs.

UNIT-II

Optimal Linear Filters: Representation of stationary random process, rational power spectra, filter parameters and auto correlation sequence.

Forward and Backward Predictors: Reflection co-efficients, AR process and Linear Prediction, Solution of normal Equations, Levinson & Durbin Algorithm, Properties of Linear Prediction error filters, AR and ARMA lattice Ladder structures.

UNIT-III

Wavelet Transforms: Introduction to Short Time Fourier Transform (STFT), Definition of Wavelet Transform and its importance in multiresolution analysis, Wavelet basis function, Mother Wavelet.

Power Spectrum Estimation: Cross correlation and Auto correlation of discrete time signals, power spectral density, periodogram, use of DFT in power spectrum estimation.

Non parametric methods for Power Spectrum Estimation: Bartlett method, Welch method, Blackman & Tukey method.

UNIT-IV

Parametric methods for Power Spectrum Estimation: estimation Autoregressive (AR) moving average(MA) and Auto regressive – Moving average (ARMA) models, Yule-Walker method, Burg method Unconstrained least squares methods.

Sequential Data algorithms for Power Spectrum Estimation: Capon's minimum variance, Pisarenko's harmonic decomposition method and Eigen decomposition method, MUSIC and ESPIRIT algorithms.

Reference Text Books:

1. John G. Proakis D. G. Monolakis, *Digital Signal Processing: Principles, Algorithms & Applications*, PHI, New Delhi.
2. S. K. Mitra, *Digital Signal processing: A computer based approach*, Tata Mc Graw – Hill, New Delhi
3. Marple, Jr. SL., *Digital Spectral Analysis with Applications,* PHI, PPR, Englewood Cliffs, New Jersey.
4. P. P. Vaidyanatham, *Multirate filter banks*, PHI, New Delhi.

MTDC 14 MICROWAVE & OPTICAL FIBER COMMUNICATION SYSTEMS

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

MICROWAVE TUBES: Introduction to Microwaves, Microwave region and bands, Applications. Microwave tubes – O type & M type classifications.**O-type tubes:** 2 cavity Klystrons – structure, velocity (Applegate) diagram, Small Signal Theory of Bunching, Principle of working and expressions for o/p power and efficiency. Reflex Klystrons – structure, Applegate diagram, Mathematical Theory of bunching, Principle of working, electronic admittance and expressions for o/p power and efficiency.**Microwave cross field tubes -M type tubes**: Magnetrons – 8 cavity cylindrical Magnetron – features, Mechanism of Oscillations, Hull cut-off conditions.

UNIT-II

Monolithic Microwave Integrated Circuits: Introduction, Materials , Monolithic Integrated Circuit growth , Mosfet fabrication, Thin-film formation, Hybrid Integrated circuit fabrication.Microwave Radiation Hazzards and Radiation Protection.

UNIT-III

Introduction to Fiber Optics: Fiber Structures. Wave-guiding and fabrications, Nature of light, Basic optical laws and definitions, Modes and Configurations, Single, Multi mode step index and Graded Index fibers.**Optical sources and Detectors**: Semiconductors as Optical Sources and their fabrication. LED and Laser Diodes, Linearity of Sources, Power launching and Coupling. Physical principles of PIN and APD, Photo Detector Noise, Detector Response time Avalanche Multiplication Noise and Photo Diode materials.

UNIT-IV

Optical Fiber Communications : Basic Communication System fundamental receiver operation ,Fiber Links: Point to Point Links, Power budget, Time Budget, Line Coding , Eye Pattern , Overview of Analog Links, Carrier Noise Ratio and Maximum length Calculations.

Opto-Electric Integrated Circuits (OEIC's) : Basic Concepts of OEIC's , Optical planer and strip Wave guides. Principles of electro-Optic effect. Guided wave devices – Phase modulator, Machzehnder Inferometer modulator and switch, Optical directional coupler and Switches.

Reference Text Books

1. Senior John M. " Optical Fiber Communications Principles and practice", PHI 2/e 1996.
2. Keiser Gerd," Optical Fiber Communications", Mc GrawHill 2/e ,1991.
3. Gowar John ," Optical Fiber Communication Systems ", PHI 2/e, 2002.
4. J. H Franz & V.K Jain." Optical Fiber Communication components & Systems" , Narosa Publishing House-2000.
5. Microwave Devices and Circuits – by Samuel Y.Liao, PHI.
6. Microwave Principles – by Herbert J.Reich, J.G.Skolnik, P.F.Ordung and H.L.Krauss, Affiliated East West Press Pvt.Ltd, New Delhi.
7. Electronic and Radio Engineering – by Frederic E.Terman, McGraw Hill Publ.
8. Microwave and Radar Engineering – by M.Kulkarni.
9. Microwave Engineering – by Annapurna Das and S.K.Das, Tata McGraw Hill.

MTDC 15 DATA COMPRESSION TECHNIQUES

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Data compression: Entropy coding-Huffman Run length, arithmetic and Ziv-Lemple coding. Speech & Image waveform characterization- Source models, Quantization Optimal & adaptive waveform coders for speech & images.

UNIT-II

Private coding-DPCM, Linear prediction, prediction for video, Adoptive prediction, motion compensative for video.

UNIT-III

Transform coding: Orthogonal transforms- Fourier, Cosine, Wavelet based approaches to speech & image compression.

UNIT-IV

Subbed coding, VQ based compression, Fratal coding of images. High quality video & audio compression for digital broadcasting. Standards for digital signal compression-data,speech, audio,images & video.

Reference Text Books:

1. M.Nelson, "The data compression book"2nd edition, BPB publications,1997.
2. Jananth & Noll, " Digital coding of waveforms-Principles and applications to speech & video", PHI,1984.
3. K.R.Rao 7 Hwang. JJ, "Techniques & standards for image, video & audio coding",PHI,1996.
4. Elliot, "Hand book of Digital Signal processing ",Academic press,1985.
5. Ning Lu, "Fractal Imagin",Academic press,1997.
6. C.S.Barrus, R.A.Gopinath & H.Guo, "Introduction to wavelets & wavelet transforms",PHI,1998.

MTDC 16(a) ADVANCED DIGITAL DESIGN
(Elective-I)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT – I

Building Blocks for Digital Design:
Multiplexers, Demultiplexers, Decoders, Encoders, Comparators, Adders, Carry-look-ahead Adder, ALU.

Building Blocks of Memory:
Clocked Building Blocks, register building blocks, RAM, ROM, PLA, PAL, Timing devices

UNIT – II

Design Methods:
Elements of Design Styles, top-down and bottom-up Machines, ASM Chart notations.

Realizing ASMs:
Traditional Synthesis from ASM Chart, multiplexer control method, one-shot method, ROM based method.

Design Case Studies:
Single pulsar, system clock, serial to parallel conversion, traffic light controller.

UNIT – III

Hierarchial Modeling Concepts:
Design Methodologies, Modules, Module instances, parts of simulation, Design and stimulus blocks, Gate level, data flow, behavioral, structural modeling techniques, switch level modeling, PLL delays.

UNIT – IV

FPGA Architecture:
Channel Type FPGAs – Xilinx, Actel, Structured Programmable Array Logic, Altera, Combinational logic arrays – Algotronix, VLSI Primitives, Benchmarking.

Design Process Flow:
Design capture, validation, physical Design, Placement, Routing and Wireability.

Suggested Text Books:

1. Prosser, Winkel, “The Art of Digital Design”, Prentice Hall, 1994.
2. Ken Martin, ”Digital Integrated Circuit Design”, Oxford University Press.
3. Oldfield, Dorf, “FPGA’s”, Prentice Hall, 1997.
4. Samir Palnitkar,”Verilog HDL”, Pearson Education Asia, New Delhi, 2001

MTDC 16(b) ARTIFICIAL NEURAL NETWORKS
(Elective-I)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Modeling the simple neuron**:** Learning by Hebb's rule, Widrow-Hoff rule. Perception learning rule and its convergence theorem; Adaline and Madaline neural networks.

Multilayered Perception – Solution of the XOR problem. Learning by error back propagation rule. Radia Basis functions and learning rule.

UNIT-II

Bidirectional associative memory**;** Hetro associative memory. Interpolative associative memory. Auto associative memory. Hopefield Memory. Bidirectional associative energy function.

Discrete and continuous Hopfiel memory. Hopfield network for A/D and Traveling salesman problems.

UNIT-III

Recurrent Neural Network**;** Stochastic networks and simulated annealing,

Architecture of a Boltzman Machine, Learning rule, issues in implementation of Boltzman Machine.

UNIT-IV

Competitive learning network**;** Components of Competitive learning network. Basic learning rules. Description of Kohonen's neural network, Learning rule and parametric selection.

Adaptive resonance theory**:** ART1, ART2 network description and learning rules.

Suggested Reading

1. Freemann JA. And Skapura DM, Neural Networks Algorithm, Applications and Programming Techniques, Addison Wesley, 1991
2. Muller B.Rienhardt,J., Neural Networks and Introduction,Springer-Verlag,1991.
3. Zurada, *Artificial Neural Networks,* TMH, NewDelhi
4. Simon Haykin. Neural Networks (A Comprehensive Foundations), McMillan College Pub.Company, New York, 1994.
5. Yegnanarayana.B,Artificial Neural Networks. PHI.
6. S. Rajashekaran, G.A. Vijaya laxmi pai" Neural Networks .Fuzzy Logic & Genetic Algorithms", PHI.

MTDC 16(c) EMBEDDED SYSTEM DESIGN
(Elective-I)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT - I

Introduction to Embedded Systems: An Embedded Systems, Processor in the System, Other Hardware Units, Software Embedded into a System, Exemplary Embedded Systems, Embedded System-On-Chip (SOC).

Processor & Memory Organization : Structural Units in a Processor, Processor Selection for an Embedded System, Memory Devices, Memory Selection for an Embedded System, Allocation of Memory, Direct Memory Access, Interfacing, Memories & I/O Devices.

UNIT - II

Devices and Buses for Device Networks: I/O Devices, Timer and Counting Devices, Serial Communication Using the 'I^2C','CAN' and Advanced I/O Buses between the Networked Multiple Devices, Host System or Computer Parallel Communication between the Networked I/O Multiple Devices Using the ISA,PCI,PCI-X and Advanced Buses.

Device Drivers and Interrupts Servicing Mechanism: Device Drivers, Parallel Port Device Drivers in a System, Serial Port Device Drivers in a System, Device Drivers for Internal Programmable Timing Devices, Interrupt Servicing (Handling) Mechanism, Context and the Periods for Context-Switching, Deadline and Interrupt Latency.

UNIT - III

Program Modeling Concepts in Single and Multiprocessor Systems Software-Development Process : Modeling Processes for Software Analysis Before Software Implementation, Programming Models for Event Controlled or Response Time Constrained real Time Programs, Modeling of Multiprocessor Systems.

Software Engineering Practices in the Embedded Software Development Process: Software Algorithm Complexity, Software Development Life Cycle and its Models, Software Analysis, Software Design, Software Implementation, Software Testing **,** Validating and Debugging, Real Time Programming Issues during the Software Development Process, Software Project Management, Software Maintenance , UML.

UNIT-IV

Inter-Process Communication and Synchronization of Processes, Tasks and Threads: Multiple Processes in an Application, Problem of Sharing Data by Multiple Tasks and Routines, Inter Process Communication.

Real Time Operating Systems: Operating System Services, I/O Subsystems, Network Operating Systems, Real-Time and Embedded System Operating Systems, Interrupt Routines in RTOS Environment : Handling of Interrupt Source Call by the RTOS's, RTOS Task Scheduling Models, Interrupt Latency and Response Times of the Tasks as Performance Metrics, Performance Metric in Scheduling Models for Periodic , Sporadic and Aperiodic Tasks, IEEE Standard POSIX 1003.LB Functions for Standardization of RTOS, List of Basic Actions in a Preemptive Scheduler and Expected Times Taken at a Processor, Fifteen-Point Strategy for Synchronization between the Processes , ISR's , OS Functions and Tasks and for Resource Management, Embedded Linux Internals : Linux Kernel for the Device Drivers and Embedded System, Security Issues, Mobile OS.

Reference Text Books:

1) "Embedded Systems", Raj Kamal, Tata McGraw Hill, 2003.
2) "Fundamentals of Embedded Software-where C and Assembly meet", Daniel W.Lewis, Pearson Education, 2002.
3) Programming Embedded Systems", Dream Tech Software Team, John Wiley Pub, 2004.

MTDC 16(d) LOW POWER VLSI DESIGN

(Elective-I)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Introduction and need of low power design sources of power dissipation and design strategies for low power. Physics of power dissipation in CMOS-low power VLSI design limits. Power estimation at circuit level – modeling of signals, signal probability calculations, statistical techniques, input vector compaction, circuit reliability. Synthesis for low power – behaviour level transforms, logic and circuit level optimization.

UNIT-II

Design styles and testing – low voltage CMOS circuit design styles, leakage current in deep submission transitions and design issues, minimization of short channel effects (SCE) and hot carrier effects. Testing of deep sub micron ICs with elevated intrinsic leakage.

UNIT-III

Low power architectures – MOS static RAM cells, banked organization SRAMS, reducing voltage swing on bit lines, write lines, driver circuits and sense amplifier circuits, Energy computing and recovery techniques – energy dissipation using an RC model, energy recovery circuit design, design with partially reversible logic and supply clock generation.

UNIT-IV

Software design for low power – dedicated hardware Vs Software implementation, power dissipation, Estimation and optimization. Automated power code generation and co design for low power.

Reference Text Books:

1. Kaushik Roy, Sharad Prasad, " Low power CMOS VLSI circuit Design", John Wiley & Sons, 2000
2. A.P. Chandrakasan, R.W.Broderson,"Low power design", IEEE Press, 1998.
3. J.B.Kuo, J.H.Juo, "Low voltage VLSI circuits" John Wiley & Sons.

MTDC 17 SEMINAR

Sessionals 100 Marks

The candidate should give an oral presentation before the Departmental Post-Graduate Review Committee (DPGRC) on any selected topic relevant to their specialization.

MTDC 18 DIGITAL COMMUNICATION LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	50 Marks
Sessional	50 Marks

Experiments based on the subjects with course codes MTDC12 and MTDC15 will be performed in this lab.

MTDC 19 MICROWAVE & OPTICAL FIBER COMMUNICATION SYSTEMS LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	50 Marks
Sessional	50 Marks

Experiments based on the subjects with course codes MTDC14 will be performed in this lab.

MTDC 21 CODING THEORY

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Elements of Digital Communication System: Channel models, introduction to abstract algebra: Fields, Polynomlal over GF2, construction of external field, Implementation of GF arithmetic.

UNIT-II

Linear block codes, syndrome decoding, Man likellhood decoding, Hard decision decoding, soft decision decoding, performance of binary block codes, Introduction to cycllc codes, Encoding and Decoding of Cycllc codes.

General description of BCH codes, decoding of binary BCH codes, Berlekamp – Massey algorithm, Euclids algorithm, Encoding structural & distance properties of convolutional codes, perbl algorithm, sequential decoding of convolutional codes. Introduction to Reed solomen codes, decoding of Reed solomen codes.

UNIT-III

Introduction to Reedsolomen codes, decoding of Reed solomen codes, Low density parity-check codes; desirable properties; constructing LDPC codes, Decoding an LDPC codes,

Turbo codes: Turbo algorithm, convergence properties of the turbo algorithm, Distance properties of turbo codes.

UNIT-IV

Application of Block codes to space communication, Mobile communication, Digital radio system, compact disc.

Reference Text Books:

1. L.H.Charles Lee, "Error – control block codes for communication Engineers", Artech House, 2000
2. Shulln Danlel J.Costello. JR, "Error control coding, Fundamentals and applications", PHI, 1st Edition, 1982.
3. Ezio Biglieri – coding for wireless channels, springer International edition (SIE), 2005.

MTDC 22 COMMUNICATION SYSTEM MODELING

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Space time propagation model, ST channel and signal models, low pass simulation models for bandpass signals and systems,

UNIT-II

Modeling and simulation of nonlinearities and time varying systems, capacity of ST channels, spatial diversity, ST coding, ST receivers, ST OPDM and spread spectrum model,

UNIT-III

MIMO and SISO modulation, MIMO BC signal model Time varying fading CH, channel estimation using higher order statistics models mobile channel modeling and estimation,

UNIT-IV

Statistical model of mobile satellite channels and modeling of wireless, mobile and adhoc networks.

Reference Text Books

1. Introduction to space time wireless communications – A PAULRAJ et al, Cambridge Univ.Press 2003.
2. Signal Processing Advances in Wireless and Mobile communication. Vol. 1 & 2. GB GIANNAKIS et al, PHPTR, 2001
3. SP for mobile communication Hand Book – M.IBANKAHLA CRC press, 2005
4. Mobile Adhoc Networking B STEFANO et al IEEE Press, 2005
5. Principles of Communication systems simulation, WH TRANTER et al,Pearson, 2004
6. Modeling telecom networks and systems architecture, THOMAS MUTH, Springer, 2001

MTDC 23 MULTIMEDIA COMMUNICATIONS & SYSTEM DESIGN

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Multimedia Communication: Introduction, Network requirements, multimedia terminals, multimedia requirement for ATM networks, Multimedia terminals, Audio Visual Integration, Audio to visual mapping.

UNIT-II

Multimedia processing in Communications: Introduction, Digital Media, Signal Processing elements, Challenges in multimedia information processing, perceptual coding of Digital audio signals, Transform audio coders, Image coding, Video coding.

UNIT-III

Distributedmultimedia systems, Resource management of DMS, IP networking, Multimedia operating systems, distributed multimedia servers, Distributed multimedia applications, Multimedia File Formats.

UNIT-IV

Multimedia communication standards, MPEG-1, MPEG-2, MPEG-4 Audio/Video, MPEG-4 Visual Texture coding (VTC), Multimedia communication across networks. Compression Techniques: JPEG, MPEG

Reference Text Books:

1. Rao, Bojkovic, Milovanovic, " Multimedia Communication Systems", PHI
2. Andleigh, Thakrar, " Multimedia System Design", PHI
3. Sharda," Multimedia Information Networking", PHI
4. Vaughan, " Multimedia making it work", Tata Mc Graw Hill

MTDC 24 DIGITAL IMAGE PROCESSING

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Introduction: Elements of Digital Image Processing system, Digital Image representation, Image model, Sampling and Quantization, Neighbors of pixel, Connectivity, Distance measures, Arithmetic and Logical operations on images, Basic Transformations such as translation, Scaling, Rotation, Perspective Transformations

Image Transforms: Two dimensional DFT and its properties, Walsh Transform, Hodamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling (K-L) Transform

UNIT-II

Image Enhancement: Brightness and contrast of an image, Simple intensity transformations – Image negatives, Linear mapping, logarithmic mapping, Gray level thresholding; Image histograms, histogram equalization, histogram specification, local enhancement; spatial filtering: smoothing filters – low pass, Rank filters, Median filters, min-max and range filters; sharpening filters – high pass, high boost and Derivative filters; Enhancement in frequency domain.

UNIT-III

Image Compression: Redundancy – Coding redundancy, interpixel redundancy, Psychovisual redundancy; Root mean square error, Image compression system model, noiseless and noisy coding, error free compression – Huffman coding, Bit-plane coding, constant area coding, lossless predictive coding; Lossy compression – Lossy predictive coding, Transform coding

UNIT-IV

Image Segmentation: Detection of discontinuities – Point detection, line detection, Edge detection, pixel connectivity; Region – Oriented segmentation – Region similarity, Region growing, Limitations of region growing, Region splitting and Merging.

Morphological Image Processing – Fitting and Hitting, Dilation and Erosion, opening and closing, Hit or Miss Transform, Basic Morphological Algorithms, grey-scale morphology

Reference Text Books:

1. R.C.Gonzalez and R.E. Woods, ***Digital Image processing***, Pearson Education, New Delhi.
2. B.chanda, D.Dutta Majumder, *Digital image processing and analysis*, Prentice Hall of India, New Delhi.
3. Nick Efford, *Digital Image Processing Using Java* , Pearson Education, New Delhi.
4. Gregory Baxes, *Digital Image Processing: Principles and Applications,* John Wiley & Sons, New York.

MTDC 25(a) DSP PROCESSORS

(Elective-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Introduction: Comparison between general purpose and Digital Signal Processors, need for specialized processors, RISC and CISC.

Data formats: Number formats for signal and coefficients in DSP systems. Dynamic range and precision, sources of error in DSP implementations: A/D conversion errors, DSP computational errors, and D/A conversion errors, Compensating filter.

UNIT-II

Architecture for Programmable DSP devices: Basic architectural features, DSP computational building blocks, Bus architecture and memory, Data addressing capabilities, Address generation unit, programmability and program execution, speed issues, features for external interfacing.

Execution Control and Pipelining: Hardware looping, interrupts, stacks, relative branch support, pipelining and performance, pipeline depth, interlocking, branching effects, pipeline programming. Control-unit of DSP's, Pipelined instruction execution, specialized hardware for zero-overhead looping.

UNIT-III

Programmable Digital Signal processors: Key features of TMS320C54X, Architecture and addressing modes, Instruction set, programming, pipelining, parallelism, on-chip peripherals and interrupts of 54x processor.

UNIT-IV

DSP Tools: Assembler, Debugger, C-Compiler, Linker, Editor, Code Composer studio (CCS).

Implementation of DSP algorithms: FFT, FIR, IIR, Adaptive and multirate filters.

Applications of DSP algorithms: Case studies of signal processing in communication and multimedia.

Reference Text Books:

1. Avtar Singh and S. Srinivasan, *Digital Signal Processing- Implementation using DSP Processors,* Thomson Brooks, 2004.
2. B. Venkatramani, M. Bhaskar, *Digital signal processors: Architecture, processing and applications,* Tata McGraw Hill, 2002.
3. Phil Lapsley,JeffBIER, Amit Shoham,E.A.Lee *DSP Processors Fundamentals-Architecture& Features*
4. IEEE Press Signal Processing, Wiley Interscience, NY.

MTDC 25(b) SATTELLITE COMMUNCIATIONS

(Elective-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

The evaluation and growth of communication satellites; other satellite systems, kepler's laws of motion, Orbital Parameters, geostationary orbits, placing a satellite in stationary orbit, choice of frequency bands propagation characteristics, Effects of Doppler, Eclipse, Sun transit etc, Noise and attenuation.

UNIT-II

Earth segment, Space segment, satellite transponders, Subsystems of a communication satellite. Satellite control, Solar cells and panels, antennas, Low noise amplifiers, High Power amplifiers. Earth station, G/T, C/N, link calculation, C/N for the complete link, and design of communication systems via satellites.

UNIT-III

Modulation, Multiplexing and multiple access techniques; TDMA, FDMA,CDMA,SSMA Reliability, Redundance; Quality assurance, Echo control and Echo suppression.

UNIT-IV

Laser Satellite Communication, Link Analysis, Optical satellite link transmitter, Receiver, Satellite, Beam Acquision, Tracking and pointing, Deep space optical communication link.

Introductory concepts of VSATS, GIS,GPS and Future trends.

Reference Text Books:

1. T.Partt & C.W.Bostian, " Satellite Communication Systems", PHI, 1st edition
2. Dr.D.C.Agarwal,"Satellite Communications," KhannaPublications, 5th Edition
3. Dennis Roddy, Satellite Communication Systems, Mc Graw Hill Publications, 1990
4. Spillker J.J.,"Digital Communication Satellite",Prentice Hall, 1977

MTDC 25(c) RADAR SIGNAL PROCESSING

(Elective-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Introduction: Classification of Raddars based on functions, Principles of operation etec.,m performance measures and interplay between Radar parameters, Target parameters and Environment parameters. Classical Detection and Estimation Theory, Binary Hypotheses testing, Likelyhood Ratio Test, Neymon square, MAP, Maximum likelyhood estimation of parameters, cramer-rao bounds, Chemood bounds.

UNIT-II

Representation of Signals, K-L expansion, Equivalent Low-pass representation of Bandpass signals and noise. Detection of lsowly fluctuating point Targetsin white noise and coloured noise. Swerling Target models. Optimum receivers. Correlator and Band pass M atohed filter receiver. PD-PF performance; coherent and non-coherent integration sub-optimum receptorn. Radar power – Aperture product.

UNIT-III

Range and Doppler reslulution: Ambiguity function and its properties. Local and Global Accuracy. Signal Design. LFM. Polyphase coded signals detection of a Doppler shifted slowly fluctuating point target return in a discrete scatterer environment.

UNIT-IV

Dobly dipersive fading Target and Clutter models – scattering function describption. Labd clutter-pluse length limited and beam width limited slutter. Sea clutter. Optimum/Sub optimum reception of Range Spread/Doppler Spread/Doubly Spread targets in the presence of noise and clutter. Introduction to adaptive detection and CFAR techniques.

Reference Text Books:

1. Di Franco.JV and Rubin, WI., "Radar Detection", Artech House, 1980.
2. Gaspare Galati (Ed), " Advanced Radar Techniques and systems", Peter Perigrinus Ltd. 1993
3. Ramon Nitzberg, " Radar Signal Processing and Adaptive Systems", Artech House, 1999
4. Lewis.BL and Frank, F.Krestchner, Jr and Wesley W.Sheldon," Aspect of Rada signal processing", Artech House, 1986.
5. (ED) simon Hay kin and Allan Steinhardt," Adaptive Radar Detection and Estimation', john Wiley, 1992.
6. Vantrees.H.L." Detection, Estimation and Modulation Theory", Wiley Part-I JohnWiley&Sons, 1968.

MTDC 25(d) RADIO NAVIGATIONAL AIDS

(Elective-II)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Review of Navigation Systems: Aircraft navigation system. Geometry of the earth . Navigation equation. Navigation errors. Radio navigation system types and performance parameters. Hyperbolic navigation systems, Loran, Omega, Decca Radio direction finding, DME, TACAN and VORTAC.

UNIT-II

Intertial navigation: Interial navigation system, Sensing instruments: Accelerometer, Gyro-scopes, Analytic and Gimballed platform, Machanization. Error analysis, Alignment

UNIT-III

Global positioning system (GPS) for Navigation: Overview of GPS, Reference systems. Satellite orbits, Signal structure, Geometric dilution of precision (GDOP, or Precision dilution of precision (PDOP), Satellite ephemeris, Satellite clock, Ionospheric group delay. Tropospheric group delay, Multipath errors and Receiver measurement errors.

UNIT-IV

Differential GPS and WAAS: Standard and precise positioning service local area DGPS and Wide area DGPS errors, wide area augmentation system (WAAS) architecture, Link budget and Data capacity, ranging function, precision approach and error estimates.

UNIT-V

GPS Navigational Application: General applications of GPS, DGPS, Marine, Air and Land Navigation, Surveying, mapping and geographical information systems, military and space.

Reference Text Books:

1. Myron Kavton and Walter Fried, R., Avionics Navigation systems, Wiley, 1997.
2. Parkinson, BW.. Spilker, Global positioning system Theory and Applications, Progress in Astronautics, Vol. I and II, 1996.
3. Hoffman. B., Wellenhof. H., Lichtenegger and J.Collins. GPS Theory and Practice, Springer Verlang wien new york, 1992.
4. Elliot D.Kaplan, understanding GPS Principles and Applications, Artech House. Inc., 1996.
5. Lieck Alfred. GPS Satellite Surveying, John Wiely, 1990.

MTDC 26(a) ADAPTIVE SIGNAL PROCESSING

(Elective-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Adaptive Signal processing: General form of adaptive linear combiner, optimum Wiener filtering, performance surface, principle of orthogonality, gradient and minimum mean-square error, input correlation matrix, eigenvalues and eigenvectors of correlation matrix, Basic applications of adaptive filtering.

UNIT-II

Gradient Search Algorithms: simple gradient search algorithm and its solution, learning curve, method of steepest descent; LMS Gradient Algorithm, Convergence analysis and misadjustment. Comparison of steepest descent and LMS algorithms, normalized LMS, sequential Regression (SER) algorithm and Linear Random Search (LRS).

UNIT-III

Least Squares Algorithm: Recursive Least Squares (RLS) and exponentially weighted RLS.

Time domain Adaptive filtering: FIR and IIR adaptive filter.

Frequency domain adaptive filter: Block LMS, Fast LMS and DFT-LMS. Computational complexity of time and frequency domain LMS algorithms.

UNIT-IV

Kalman Filter Theory: Recursive minimum mean square estimation of scalar random variables, statement of the Kalman filtering problem, innovation process, estimation of state using the innovation process. Application of Kalman filters to target tracking.

Reference Text Books:

1. Simon Haykin, *Adaptive Filter Theory*, PHI, New Delhi
2. Bernard Widrow, S. D. Stearns, *Adaptive signal processing*, Pearson Education.
3. D.G.Manolakis, Ingle & S.M.Kogon, Statistical and Adaptive Signal Processing, :MGH.

MTDC 26(b) WIRELESS & MOBILE COMMUNICATIONS

(Elective-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Basic cellular mobile communication system- the cellular concept- System design fundamentals-Frequency reuse- Channel assignment strategies, Handoff strategies, power control, Interference and system capacity, improving coverage and capacity in cellular systems.

UNIT II

Mobile radio propagation-Large scale path loss-Introduction to radio wave, free space propagation model, Three basic propagation mechanisms, Reflection, ground reflection (two ray) model, Diffraction, Scattering,

Practical link budget design using path loss models, Out door propagation models, Indoor propagation models, Signal penetration into buildings.

UNIT III

Mobile radio propagation-Small scale fading and multi path, Small scale multipath propagation, Impulse response model of a multipath channel, Small scale multipath measurements, parameters of mobile multipath channels, **Types of small scale fading,** Rayligh and Ricean distributions, Statistical models for multipath fading channels.

UNIT IV

Multiple access techniques for wireless communications-FDMA, TDMA, Spread spectrum multiple access (SDMA), Packet radio, CSMA, Reservation Protocols.

Wireless systems and standards – Evaluation of wireless systems, study of AMPS, IS-54, IS-136, GSM, IS-95, CDMA-2000, WCDMA, Introduction to Fourth generation systems.

Reference Text Books:

1. Theodore S. Rappaport, Wireless communications principles and practice PHI, 2nd Edition, 2002.

2. V.K. Garg, IS-95 CDMA& CDMA 2000, Pearson Education, 2002

3. William Stallings, Wireless communications & Networks, Pearson Education-2002

4. William C.Y Lee, Mobile Cellular Tele communications, McGraw-Hill, 2nd Edition, 1995.

MTDC 26(c) ADHOC & WIRELESS SENSOR NETWORKS

(Elective-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Wireless LANS and PANS: Introduction, fundamentals of WLANS, IEEE 802.11 Standard, HIPERLAN Standard, Bluetooth, Home RF.**Wireless Internet:** Wireless Internet, Mobile IP, TCP in wireless Domain, WAP, Optimizing web over Wireless.

Adhoc Wireless Networks: Introduction, Issues in Ad hoc wireless networks, Adhoc wireless Internet.**MAC Protocols for AdHoc Wireless Networks:** Introduction, Issues in Designing a MAC Protocol for classifications of MAC Protocols, Contention – Based Protocols, Contention – Based Protocols with reservation Mechanisms, contention – Based MAC Protocols with scheduling mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT-II

ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing for Ad Hoc wireless Networks, Classification of Routing Protocols, Table – Driven routing Protocols, on-Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with efficient flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

TRANSPORT LAYER AND SECURITY PROTOCOLS: Introduction, Issues in Designing a Transport Layer Protocol for Adhoc wireless Networks, Design Goals of a Transport Layer Protocol for Adhoc wireless networks, classification of Transport Layer solutions, TCP over Adhoc wireless networks, other transport layer protocol for Adhoc wireless networks, security in Adhoc wireless networks, Network security Requirements, Issues and challenges in security provisioning, Network security Attacks, Key Management, Secure Routing in Adhoc wireless networks.

UNIT-III

Quality of Service: Introduction**,** Issues and challenges in providing QoS in Adhoc wireless Networks, Classification of QoS solutions, MAC Layer solutions, Network Layer solutions, QoS frameworks for Adhoc wireless networks.

ENERGY MANAGEMENT: Introduction, need for energy Management in Adhoc wireless networks, classification of Adhoc wireless networks, Battery Management schemes, Transmission power Management scheme, System power management schemes.

UNIT-IV

WIRELESS SENSOR NETWORKS: Introduction, Sensor network Architecture, Data Dissemination, Data gathering, MAC protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving standards, Other Issues.

Reference Text Books:

1. Adhoc wireless networks: Architectures and Protocols – C.Siva Ram Murthy and B.S Manoj, 2004, PHI.
2. Wireless Adhoc and sensor Networks: Protocols, Performance and control – Jagannathan sarangapani, CRC Press
3. Adhoc Mobile wireless Networks: Protocols & Systems, C.K.Toh, 1 ed.Pearson Education.
4. Wireless sensor Networks - C.S.Raghavendra, Krishna M.Sivalingam, 2004, Springer

MTDC 26(d) QUANTUM COMMUNICATION
(Elective-III)

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	100 Marks
Sessional	50 Marks

UNIT-I

Quantum mechanics basics: Hilbert Space, density matrices, projective measurements, pure states and mixed states. Observables and commutivity, Heisenberg uncertainty principle, Quantum state preparation. Open and closed Quantum system Dynamics – Definition, unitary evolution of density matrices, requirements of closed and open system quantum maps, reduced density matrices, partial trace operator, open system measurements and positive operator valued Measurements, stinespring theorem,Kraus Representation theorem for open system quantum evolution.

UNIT-II

Quantum Communication Theory: Transmission of classical information over quantum channels. Classical bits encoded into the Z axis spin projection of an electron, quantum state encoding and decoding

Quantum Information Theory : Von Neumann entropy, Holevo's theorem on mutual information for ensembles of quantum states.

UNIT-III

Quantum state Compression: Compressing ensembles of quantum states, relation of pure state ensemble compression with von Neumann entropy, relationship between mixed state compression and Holevo's theorem, connections between compression ideas and communication channel capacities.

Holevo-Schumacher-Westmoreland theorem for classical channel capacities of quantum channels, King Ruskai-Swarez-Werner Qubit Channel Representation Theorem, Kraus channel representation, channel capacities and their relation to the von Neumann entropy.

UNIT-IV

Entanglement and Quantum Channel Capacity - entanglement, scaling issues in Hilbert space, notion of channel additivity and the role of entanglement in quantum channel capacity calculations

Quantum Communication over Quantum Channels- notion of quantum communication over quantum channels, Shor result on entanglement assisted channel capacities for the transmission of quantum states over quantum channels.

Quantum coding theory-Shor 9 qubit code to protect against bit flips and phase flips, Calderbank-Shor-Steane(CSS) codes, stabilizer code construction technique.

Text book

1. Michael Nielsen and Issac Chuang: Quantum Computation and Quantum Information, Combridge University Press, 2000

MTDC 27 ADVANCED DIGITAL SIGNAL PROCESSING LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	50 Marks
Sessional	50 Marks

Experiments based on the subjects with course code
MTDC 13 will be performed in this lab

MTDC 28 COMMUNICATION SYSTEM MODELING & SIMULATION LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hrs
University Examination	50 Marks
Sessional	50 Marks

Experiments based on the subjects with course codes
MTDC 22 will be performed in this lab.

(Experiments given in
Principles of communication systems simulation, WH TRANTER et al, Pearson, 2004.)

MTDC 29 COMPREHENSIVE VIVA - VOCE

University Examination 100 Marks

MTDC 31 INDUSTRIAL TRAINING

Duration	8 weeks
Sessional	Satisfactory/Not Satisfactory

The candidate should submit the report and present talk on the training under gone high lighting the contents of the report before the internal evaluation committee.

MTDC 32 DISSERTATION

Duration	18 weeks
Sessional	100 marks

The candidate will choose the topic of the Project Work in consultation with the guide allotted. A report in the prescribed format is to be submitted that includes extensive survey of literature on the topic, highlighting the scope of the work. It should also state the methodology to be adopted and work involved in the project work. The report should clearly specify the expected outcome.

The candidate should submit the report and give an oral presentation on the Project Work before the Departmental Post-Graduate Review Committee (DPGRC).

MTDC 41 DISSERTATION & VIVA VOCE

Duration	24 weeks
Sessional	100 marks
University Examination	100 marks

The candidate should submit the report give an oral presentation on the Project Work highlighting the conclusions drawn and results of the work before the DPGRC.