SCHEME OF INSTRUCTIONS AND EXAMINATION (R-2007)

UNIVERSITY OF MUMBAI

COURSE: ELECTRONICS AND TELECOMMUNICATION ENGG.

Second Year Engineering (Semester III & IV) (Revised-2007) Courses for Academic Year 2008-09, Electronics and Telecommunication Engineering Scheme for

Semester IV

Sr. No.	Subjects	No. of Periods per week			Duration of Theory Paper(Hrs)	Marks				
		Lectures	Practical	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1	Applied Mathematics-IV	4	-	-	3	100	-	-	-	100
2	Analog & Digital IC-Design & Applications	4	2	-	3	100	25	-	25	150
3	Principle of Communication Engineering	4	2	-	3	100	25	50	25	200
4	Electronic Devices & Circuits II	4	2	-	3	100	25	50	25	200
5	Electromagnetic Wave Theory	4	2	-	3	100	25	-	25	150
6	Simulation Software workshop	-	2	-	-	-	25	-	25	50
Total		20	10	-	-	500	125	100	125	850

Class: S.E. (Electronics & Telecommunication Engg.) **Semester-IV**

Subject: -Applied Mathematics-IV

Periods per week	**Lecture**	**4**	
	Practical	**--**	
01 Period of 60 min	**Tutorial**	**--**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**3**	**100**
	Practical Examination	**--**	**--**
	Oral Examination	**-**	**--**
	Term Work	**-**	**--**
	Total		**100**

Detailed Syllabus: **Hours**

4.1 Bessel Function **12 Hours**

1. Relation between Laplace and Bessel's differential equation, its solution by series method, Bessel function of first and second kind, Recurrence relations for,

2. Generating function of, Orthogonality of, Bessel-Fourier series of a function.

4.2 Matrices **10 Hours**

1. Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), Similar Matrices, Orthogonally Similar Matrices

2. Functions of square Matrix, Dcrogatory and Nonderogatory Matrices.

4.3 Matrices and Complex Variables **12 Hours**

1. Quadratic forms over real field, Reduction of Quadratic form to a diagonal canonical form Rank, Index and Signature quadratic form, Sylvester's law of inertia

2. Value- class of a quadratic form-Definite, Semidefinite and Indifinite.

3. Functions of a Complex variable, Analytic Functions, Cauchy- Riemann equations in Cartesian and Polar-co-ordinates.

Harmonic functions, Analytical method and Milne Thomson.

4.4. Complex Variables **10 Hours**

1. Conformal Mappings and Bilinear transformations, Cross-Ratios, Fixed points of Bilinear Transformations.

2. Complex Integration

Complex line intergral, Cauchy's Integral theorem for simply. Connected regions (with proof) and Cauchy's Integral formula. (with proof);

4.5 Complex Variables **6 Hours**

1. Taylor's and Laurent's development (without proof) Zeros, Singularities and poles of function, Residue theorem (with proof)

2. Real definite Integrates of the form

4.6 Vector Integration **10 Hours**

1. Line Integral, Properties of Line Integrals, Conservative fields, Scalar potentials.

2. Green's Theorem in a plane (Statement only), Surface Integrals, Divergence Theorem (statement only) Stoke's Theorem (statement only)

Theory Examination:

1. Question paper will be comprising of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. One question will be compulsory and based on entire syllabus.
4. Remaining questions will be mixed in nature. (e.g. suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3)
5 In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Recommended Books:

1. Vector Analysis by Murray R. Spiegel, Schaum's Outline Series – McGraw Hill Publication.

2. Complex Variables by Murrey R. Spiegel, Schaum's Outline Series –McGraw Hill Publications.

3. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publications

4. Mathematical Methods by J N Sharma and R. K. Gupta, Krishna Prakashan Mandir (P) Ltd.

5. Calculas by Thomas, Finney, 9^{th} Edition, Person Education

6, Linear Algebra and Application by Gilbert STrang, 4^{th} Edition, Thompson Books/Cole.

7. Matrices by Shantinarayan, S. Chand Publications

8. A Text Book of Applied Mathematics Vol.I & II by P.N. Wartikatr & J.N. Wartikar, Pune Vidyarthi Griha Prakashan.

Class: S.E. (Electronics & Telecommunication Engg.) **Semester-IV**

Subject: - Analog and Digital IC-Design and Application

Periods per week	**Lecture**	**4**	
	Practical	**2**	
01 Period of 60 min	**Tutorial**	**--**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**3**	**100**
	Practical Examination	**--**	**--**
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**100**

Module	**Contents**	**Hours**
Objective	**This subject is a study of analog and digital integrated circuits and their applications. Many applications are best addressed by mixed-mode integrated circuits and systems, which relay on analog circuitry to interface with physical world, and digital circuitry for processing and control.**	
Pre- requisite	**Introductory course in electronics (EDC) to be conversant.**	
1.	**Circuits with Resistive Feedback:** Basic Op-Amp Configurations, Ideal Op-Amp Circuits analysis, Negative Feedback, Current –to-Currents Converters, Current Amplifier, Difference Amplifier, Instrumentation Amplifier, Instrumentation Applications.	**8 Hours**
2.	**Active Filters:** The Transfer function, First-Order Active Filters, Standard Second-Order Responses, KRC Filters, Multiple-Feedback Filters, State-Variable and Biquad Filters, Filter approximations, cascade design, generalized impedance converters, direct design, Switched capacitor filters.	**8 Hours**
3.	**Analog IC's** All Types of A/D Converter. Comparator Circuits and their applications, Sample and Hold Circuits, IC Power Amplifier. Analog Multipliers(Logarithmic multipliers, Log and Antilog Amplifiers. 555 Timer. VCD ICs (566) PLL ICs(565, 4046B). Function Generator IC 8038, XR 2206.	**8 Hours**
4	**Sequential Logic Design:** Sequential Circuits documentation standards, use of latches and flipfloops like switch depbouncing, counters ripple, synchronus and MSI, decoding binary counter states, counter in VHDL. Shift Registers, ring counter, Johnson counter, linear feedback shift register counter, Shift register in VHDL.	**10 Hours**
5	**Synchronus logic Design Practices:** Sequential Circuits documentation standards, use of latches and flipflops like switch debouncing, counters-ripple, synchronus and MSI, decoding binary counter states, counter in VHDL. Shift Registers, ring counter, Johnson counter, linear feedback shift register counter, Shift register in VHDL.	**10 Hours**

6	**Memory, CPLDs and FPGAs**	**8 Hours**
	Types of memory devices, Read Only Memory (ROM), Read / Write memory, Static RAM, Dynamic RAM, Introduction to Xillinx XC 9500 CPLD family and Xilinx XC 4000 FPGA family.	

Theory Examination :

1. Question paper will be comprise of total 7 questions, each of 20 marks.
2. All questions must be analytical and design oriented.
3. Only 5 questions need to be solved including compulsory question no.1 which must cover all the topics given in the syllabus of the said subject.
4. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
5. No question should be asked from **pre-requisite module.**

Oral Examination:

Oral Examination will be based on any experiment performed from the list of experiment given in the syllabus and the entire syllabus.

Term Work:

Term Work shall consist of minimum eight experiments and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal): 10 marks

Test (at least one) : 10 marks

Attendance (Practical and Theory): 05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

List of laboratory experiments:

1) V-I and I-V converter.
2) Designing an Instrumentation amplifier for desired gain and testing practically the same.
3) Design, build and practically testing of 2^{nd} order Low-pass, High-pass and Band-pass KRC filters for given cut-off or pass-band frequencies and Q.
4) Design, build and practically testing of R-2R ladder type A/D converter.
5) To build and practically testing of R-2R ladder type A/D converter.
6) Synchronus and asynchronus counter.
7) SISO and universal shift register
8) Design of MELAY Machine.
9) Design of MOORE Machine.
10) VHDL programs for counter's shift register's Melay and Moore machine.

Recommended Books:

1. Design with Operational Amplifiers and Analog Integrated Circuits, Sergio Franco, 3rd edition, McGraw Hill International edition, 2002.
2. Digital Logic Design Principles, Norman Balabnian and Bradley Garlson, John Wiely and Sons, 2004.
3. Fundamentals of Digital Logic with VHDL Design, Stephen Brown & Zvonko Vranesic, First Edition, McGraw Hill International edition, 2002.
4. Micro Electronic Circuits, S. Sedra and K.C. Smith, Saunders College Publishing, Third Edition, 1991.
5. Digital Integrated Electronics, H. Taub and D. Schilling, McGraw Hill Publications, 1997.

Class: S.E. (Electronics & Telecommunication Engg.) **Semester-IV**

Subject: - Principle of Communication Engineering

Periods per week	**Lecture**	**4**	
	Practical	**2**	
01 Period of 60 min	**Tutorial**	**--**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**3**	**100**
	Practical Examination	**3**	**50**
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**200**

Module	**Contents**	**Hours**
Objective	**To understand the fundamentals of communication engineering. To understand the concept of Broadcasting.**	
Pre-requisite	**Working of semiconductor devices like diode, BJT and JFET. Working or R-L-C resonance.**	
1	**Introduction:** Elements of a communication system, modulation and demodulation. Noise in Communication systems, Signal-to-Noise ratio, Noise factor and Noise Figure, Equivalent Noise Temperature.	**10 Hours**
2	**Amplitude Modulation:** DSB Full carrier AM principles, modulator circuits, transmitters. Different types of AM, Suppressed carrier AM, SSB,ISB- Principles, transmitters.	**10 Hours**
3	**Angle Modulation:** Frequency modulation, Phase modulation, Effect of noise, FM modulators, Transmitters.	**10 Hours**
4	**Radio receivers:** Receiver characteristics, TRF and Super heterodyne receivers, AM detectors, AM detectors, FM detectors, Receiver circuits.	**10 Hours**
5	**Analog Pulse Modulation:** Sampling Theroem for Low – pass and Band- pass signals – proof with spectrum, Aliasing. Sampling Techniques – principle, generation, demodulation, spectrum. PAM, PWM, PPM – generation and detection.	**10 Hours**
6	**Digital Transmission:** Quantization, Quantization error, Non-uniform quantizing, Encoding PCM, DPCM, Delta modulation, Adaptive Delta modulation- transmission, Adaptive Delta modulation – transmission system, bandwidth.	**10 Hours**

Theory Examination:

1. Question paper will be comprising of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. One question will be compulsory and based on entire syllabus.
4. Remaining questions will be mixed in nature. (e.g. suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3)
5 In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
6. No question should be asked from **pre-requisite module.**

Practical Examination:

Practical Examination will be based on any one experiment performed from the list of experiment given in the syllabus and the evaluation based on the same experiment.

Oral Examination:

Oral Examination will be based on any experiment performed from the list of experiment given in the syllabus and the entire syllabus.

Term Work:

Term Work shall consist of minimum eight experiments and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal): 10 marks

Test (at least one) : 10 marks

Attendance (Practical and Theory): 05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

List of laboratory experiments:

1. Generation (DSB-FC) and detection of AM signal.
2. Generation (DSB-SC) and detection of AM signal
3. Generation (SSB-SC) and detection of AM signal
4. Generation and detection of FM signal.
5. Study of AM broadcast transmitter.
6. Study of AM broadcast receiver (superhet).
7. Study of AM broadcast receiver (superhet).
8. Measurement of sensitivity, selectivity and fidelity of broadcast receiver (superhet).
9. Generation of PAM signal and verify the sampling theorem.
10. Generation of PWM and PPM signal.
11. Generation of PCM.
12. Generation of DM.

Recommended Books:

1. Wayne Tomasi, Electronic Communication Systems, Pearson Education, third edition,2001.
2. Roy Blake, Electronic Communication Systems, Thomson Asia Pte. Ltd., Singapore, second edition,2002
3. Leon W Couch, Digital and Analog Communication Systems, Pearson Education, sixth edition.
4. Herbert Taub and Donald Schilling, Principles of Communication Systems, Tata McGraw-Hill, second edition.
5. Haykin Communication Systems, Wiley
6. William Stanley, Electronic Communication: Principles & Systems, Cengage(Thomson)
7. Alencar, Communication systems, Springer.

Class: S.E. (Electronics & Telecommunication Engg.) **Semester-IV**

Subject: - Electronic Devices & Circuits-II

Periods per week	**Lecture**	**4**	
	Practical	**2**	
01 Period of 60 min	**Tutorial**	**--**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**3**	**100**
	Practical Examination	**3**	**50**
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**200**

Module **Contents** **Hours**

Objective **To understand the analysis and synthesis/design of BJT and JFE applications. To understand the concept of design.**

Pre-requisite **DC/AC Analysis of BJT and JFET**

1. **Frequency response:** **5 Hours**
   General concepts, decibels, low frequency response characteristic, Gain bandwidth product, high frequency response of cascade amplifiers, effect of low frequency and high frequency on coupling and bypass capacitors.
2. **Multistage amplifiers:** **15 Hours**
   RC coupled, transformer coupled, direct coupled, Low and high frequency considerations, cascade amplifier, darlington pair, their performance. Analysis and design considerations of multistage amplifiers, effect of source and load resistance. Differential amplifiers, their types, small signal analysis, differential stage, level shifter.
3. **Large signal amplifiers:** **13 Hours**
   Harmonic distortion and power efficiency of Class A,B, AB and C Amplifiers. Thermal considerations and design selection of heat sinks.
4. **Feedback amplifiers:** **12 Hours**
   Feedback concept, ideal feedback amplifier, classification of feedbacks, Topology, analysis and design of different types of negative feedback, General analysis of multistage of multistage feedback and multiloop Feedback amplifiers
5. **Oscillators:** **10 Hours**
   Principle of oscillation, RC oscillator, Wein bridge oscillator, twin T oscillator, oscillator with LC feedback. Colpitt oscillator, clap oscillator, Armstrong oscillator, Crystal controlled oscillator.
6. **Multivibrator Circuits:** **5 Hours**
   Bistable Multivibrators, Schmitt Trigger**,**

   Monostable Multivibrator, Retriggerable Monostable Multivibrator, Astable Multivibrator.

Theory Examination :

1. Question paper will be comprising of total 7 questions, each of 20 marks.
2. All questions must be analytical and design oriented.
3. Only 5 questions need to be solved.
4. Two questions will be compulsory and based on design of BJT / JFET circuits given in syllabus.
5. Remaining questions will be mixed in nature. (e.g. suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3)
5. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
6. No question should be asked from **pre-requisite module.**

Practical Examination:

Practical Examination will be based on any one experiment performed from the list of experiment given in the syllabus and the evaluation based on the same experiment.

Oral Examination:

Oral Examination will be based on any experiment performed from the list of experiment given in the syllabus and the entire syllabus.

Term Work:

Term Work shall consist of minimum eight experiments and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal): 10 marks

Test (at least one) : 10 marks

Attendance (Practical and Theory): 05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

List of laboratory experiments:

1) Frequency response and performance parameters of two stage BJT amplifier.
2) Frequency response and performance parameter of two FET amplifier.
3) Design Multistage BJT amplifier and finding its parameters, Verify.
4) Voltage series feedback using BJT/FET . It's effect on frequency response.
5) Current series feedback using BJT/FET. It's effect on frequency response.
6) Design Multistage JFET amplifier and finding its parameters, verify.
7) Design and Verify oscillator for different amplitude and frequency.
8) RC Phase shift oscillator for different amplitude and frequency.
9) Colpitt / Hartley oscillator.
10) Class C amplifier and its efficiency.
11) Design Cascode BJT amplifier and finding its parameters, Verify.
12) Design Difference BJT amplifier and finding its parameters, Verify.
13) Design Astable Multivibrator, Verify.
14) Design Monostable Multivibrator, Verify.

Recommended Books:

1. Foundations of Electronics: circuits & devices, Russell L Meade, Cengage (Thomson)
2. Microelectronic Circuits Analysis and Design Rashid, PWS Publishing
3. Electronic Circuit Analysis and Design, Donald, A Neamen, TMH
4. Electronics devices and circuit theory – Boylestad Nashelsky, Pearson Education.
5. Electronic Devices and Circuits by A.K. Maini, Wiley
6. Electronic Devices – Floyd, Pearson Education Asia Publication.
7. Microelectronics – Jacob Millman & Arcin Grabel,Mc-Graw Hill publication.

Class: S.E. (Electronics & Telecommunication Engg.) **Semester-IV**

Subject: - Electromagnetic Wave Theory

Periods per week	**Lecture**	**4**	
	Practical	**2**	
01 Period of 60 min	**Tutorial**	**--**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**3**	**100**
	Practical Examination	**-**	**--**
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**150**

Module	**Contents**	**Hours**
Objective	**To understand the fundamentals of Electromagnetic wave.**	
Pre-requisite	**Primary idea of electronic and magnetism.**	

1.Coulomb's law and electric field intensity: **16 Hours**

Coulomb's law, electric field intensity, calculation of electric field intensity for various charge distributions, streamlines and sketches of field.

2.Electric flux density and Gauss's law: **08 Hours**

Electric flux density, Gauss's law, applications of Gauss's law, vector operator and divergence theorem.

3.Energy and Potential: **08 Hours**

Energy expended in moving a point charge in an electric field, line integral, potential and potential difference, calculations of electric field of both point charge and system of charges, potential gradient, dipole, energy density.

4. Conductors, Dielectrics, Capacitance:

Current and current density continuity of current, conductor properties, Dielectric material and properties, capacitance, calculation of capacitance of various configurations method of images

5. Poisson and Laplace's equations: **08 Hours**

Poisson and Laplace's equation and its applications, uniquness thorem, product solution of Laplace's equation.

6. Steady magnetic field:

Biot Savart law, Ampere's circuital law, curl of H, stoke's theorem, Magnetic flux and flux density, scalar and vector magnetic potentials of steady magnetic field lines.

7. Time Varying Fields and Maxwell's equations: **08 Hours**

Faraday's law concept of displacement currents, Maxwell's equations in point form, Maxewll's equations in Integral form, Boundary conditions and significance of Maxewll's equations.

8. Uniform Plane Waves: **16 Hours**

Uniform Plane Waves in time domain in free space, sinusoidally time varying uniform plane waves in free space, wave equation and solution for material uniform plane. Waves in dielectrics and conductors, reflection of uniform plane waves, significance of plane waves, polarization of waves.

9. Poynting Vector and flow of power:
Poynting theorem, power flow for a plane wave, power flow in a concentric cable, Poynting vector about R-C lines, heterogeneous average and complex Poynting vector, Poynting vector, Poynting loss in a Plane conductor.

Theory Examination :
1. Question paper will be comprising of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
4. Two questions will be compulsory and covering the entire syllabus.
5. Remaining questions will be mixed in nature. (e.g. suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3)
5 In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
6. No question should be asked from **pre-requisite module.**

Oral Examination:
Oral Examination will be based on any experiment performed from the list of experiment given in the syllabus and the entire syllabus.

Term Work:
Students are required to perform maximum six simulation experiments.

It should be divided as (module 1,2) two using PSPICE, (Module 3,4) two using HDL and (module 5,6) two using SciLab / MATLAB. Apart from this students should prepare list of the (7) most basic commands used in LINUX environment. Also one report on the (8) LINUX files system. All experiment reports should include details about the tools used, syntax, commands, etc. Students should be encouraged to use internet as a resource to learn and implement these experiment.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal) : 20 marks.
Attendance (Practical) : 05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

<u>Recommended Software:</u>

- Design and simulation of analog circuits of PSPICE
- Design and simulation of basic digital circuits using HDLs like or /and Verilog.
- Xilinx 9.2i with its own simulation tool.
- SciLab / MATLAB, one tool for design and simulation of systems.
- LINUX operating system.

List of laboratory experiments:

1. Study of co-ordinate system.
2. Study of coulomb's law.
3. Study of Faraday's cage.
4. Study of static magnetic field.
5. Study of magnetic induction.

Recommended Books:

1. Engineering Electromagnetic- – William H. Hayt, Tata Mc-Graw Hill publication.
2. Elements of Electromagnetics, Sadiku, Oxford.
3. Engineering Electromagnetics, Ida, Nathan, 2nd edition, Springer.
4. Elements of Engineering Electromagnetics- Nannapnaeui Narayan Rao Prentice Hall of India publication
5..Electromagnetic Waves and Radiating Systems. Edward C. Jordan. Keith G Balmain, Pearson.

Class: S.E. (Electronics & Telecommunication Engg.) **Semester-IV**

Subject: - Simulation Software Workshop

Periods per week	**Lecture**	**-**	
	Practical	**2**	
01 Period of 60 min	**Tutorial**	**--**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**-**	**-**
	Practical Examination	**-**	**--**
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**50**

Module	**Contents**
Objective	**Students should get extensive experience in using the most popular simulation tools used worldwide. This will give them confidence in coupling theory with practice and make them aware of trends in design and simulation of both research and industry.**
Pre-requisite	**Computer fundamentals.**
1	Analog circuits (BJT/FET/MOSFET/IC)
2	Digital circuits (Combinational and Sequential circuits)
3	Communication fundamentals
4	Signal analysis and processing fundamentals
5	Electromagnetic Wave Theory
6	Computer programming skills

Our course prescribes that students should get extensive experience in using the most popular simulation tools used worldwide. This will give them confidence in coupling theory with practice and make them aware of trends in design and simulation of both research and industry. This should include learning design and simulation of analog circuits in PSPICE using both schematics and net listing. (either of them) will give students an introduction to digital VLSI. We recommend use of Xilinx 9.21 which is completely free and comes with its own simulation tool. SciLab/MATLAB is one tool which is used through the world for design and simulation of systems.
Student should be given in-depth knowledge about its use and should be excelled in using at least one of its tool-box thoroughly. Since many of the VLSI design tools used in industry (such as CADENCE) are LINUX operating system. This should include understanding the file system, use of command terminal, installation procedure of software packages, etc.

Apart from the prescribed course work, instructors are requested to use their own innovations and ideas to help students excel in use of these simulation Software Package can also be added to the course work.