UNIVERSITY OF MUMBAI
No.UG / 253 of 2009

CIRCULAR :-

A reference is invited to the Ordinances, Regulations and syllabi relating to the Bachelor of Engineering degree courses *vide* this office Circular No.UG/461 of 2003, dated 19th September, 2003 and the Principals of the affiliated colleges in Engineering are hereby informed that the recommendation made by the Faculty of Technology at its meeting held on 1st April, 2009 has been accepted by the Academic Council at its meeting held on 27th May, 2009 *vide* Item No.4.14 and that, in accordance therewith, the syllabus for the Third Year Electronics Engineering (Sem. V and VI) of the B.E. degree course is revised as per Appendix and that the same has been brought into force with effect from the academic year 2009-2010.

MUMBAI-400 032
7th July, 2009

PRIN K VENKATARAMANI
REGISTRAR

To,

The Principals of the affiliated colleges in Engineering.

A.C./4.14/27.05.2009

No.UG/253- A of 2009, MUMBAI-400 032 7th July, 2009

Copy forwarded with compliments for information to: -

1) The Dean, Faculty of Technology.
2) The Chairman, Board of Studies in Electrical Engineering.
3) The Controller of Examinations,
4) The Co-ordinator, University Computerization Centre.

07/07/09

(D.H. KATE)
DEPUTY REGISTRAR
(U.G./P.G SECTION)

Copy to: -

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Director, Institute of Distance Education, (10 copies) the Director University Computer Center (IDE Building), Vidyanagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar,(PRO) , the Assistant Registrar, Academic Authorities Unit (2 copies)and the Assistant Registrar, Executive Authorities Unit (2 copies) . They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above Circular and that, no separate Action Taken Report will be sent in this connection. the Assistant Registrar Constituent Colleges Unit

Enclosure to Item No. 4.14
27.5.2009

UNIVERSITY OF MUMBAI

Revised Syllabus for the
Third Year Electronics Engineering
(Semester V & VI)

(With effect from the academic year 2009-2010)

UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTION AND EVALUATION (R2007)
COURSE: B.E. (ELECTRONICS ENGINEERING)

SEMESTER: V

Subjects	No. of periods of 1Hour			Duration of Theory Paper in Hours	Marks				
	Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical /Oral	Oral	Total
Continuous Time Signal & System	4	2	--	3	100	25	--	25	150
Microprocessor and microcontroller-I	4	2	--	3	100	25	25		150
Electromagnetic Engineering	3	---	1	3	100	25	--		125
Linear Integrated circuits and Design	4	2	--	3	100	25	25		150
Digital communication and coding Techniques	4	2	---	3	100	25		25	150
EVS	2		1#	2	50	25	---	---	75
Electronics Workshop II	---	4	---	---	---	---	---	50	50
TOTAL	21	12	2	--	550	150	50	100	850

Classwise tutorial

COURSE: B.E. (ELECTRONICS ENGINEERING)

SEMESTER: VI

Subjects	No. of periods of 1Hour			Duration of Theory Paper in Hours	Marks				
	Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical /Oral	Oral	Total
Discrete time Signal and System	4	2	--	3	100	25	--	25	150
*Microprocessor and microcontroller-2	4	2	--	3	100	25	25	--	150
Microwave devices and circuits	4	2	--	3	100	25			125
Electronics Instrumentation System	4	2	--	3	100	25	--	25	150
Power Electronics	4	2	--	3	100	25	25	--	150
Elective -1 • Communication Systems and Applications • Medical Electronics • Computer Organization	4	2	--	3	100	25	--		125
TOTAL	24	12	--	--	600	150	50	50	850

University of Mumbai		
CLASS: T.E. (Electronics Engineering)		Semester – V
SUBJECT: Continuous Time signals and systems		
Periods per week (each of 60 min.)	Lecture	4
	Practical	–
	Tutorial	–
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical examination	–	–
	Oral Examination	–	25
	Term Work	–	25
	Total		150

Objective	1. To introduce the student to the idea of signals and systems analysis and characterization in continuous domain. 2. To provide a foundation to numerous other courses that deal with signal and system concepts directly or indirectly: viz: communication, control, statistical signal processing etc	
Pre-requisite	Basic knowledge of Fourier analysis ,Laplace Transform and sampling theorem	
Module	contents	Hours
1	**Introduction to signals & Systems** Definition of Signal Elementary Continuous Time (CT) signals like unit step, Impulse, ramp, exponential, sinusoidal etc. Operations on signal like shifting, flipping, scaling, addition, multiplication Breaking of a CT signal in different basic components Concept of system Classification of system on the basis of linearity, time variance, causality, memory ,stability, invertibilty etc System representation by a differential equation	10
2	**Convolution and correlation** Concept of Impulse Response Convolution integral and system response in CT domain Properties, Autocorrelation and its property. Relation of autocorrelation to signal energy, power, ESD, and PSD. Cross correlation and its property.	6
3	**Fourier Series (FS) & Fourier Transform (FT) for CT systems** Review of Trigonometric series, Exponential series properties and uses Amplitude & phase spectra Power Spectral Density	12

	Parseval's relation, Relation between Trigonometric and Exponential Fourier series, Gibbs Phenomenon The Fourier Transform (FT) FT of basic signals Properties of FT and derivations FT of periodic signals Conceptual introduction to C.T. short time Fourier Transform (STFT) Energy Spectral Density Analog to Digital conversion & its Reconstruction	
4.	**Fundamentals of Random processes** Introduction, concept of random variable, PDF of uniform, Gaussian and exponential random variable. Properties of Mean, variance and moments. Two or more random variables , Random processes	6
5.	**Laplace transform analysis of signals and systems** Definition & properties of Two-sided & one-sided Laplace Transform. Region of Convergence (ROC) inverse Laplace transform Relationship with Fourier Transform & mapping BIBO stability and ROC Pole-zero diagram Impulse response of a system, and impulse response of cascade and parallel systems Time domain analysis for first and second order systems Solution to differential equations and system behavior. Zero state & zero input responses System response to complex exponential inputs.	08
6.	**State -Variable Techniques** State –Variable concepts and state variable model , TF from state variable model and vice versa. Digonalization State equations & their time domain and frequency domain solutions State transition matrix System state equations	6

Text- Books:

1. S. Haykin, Signals and Systems . Wiley Eastern Publication
2. M J. Roberts, Fundamentals of Signals and Systems, second reprint, Tata McGraw-Hill, 2008
3. J.G. Proakis, D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and applications, Prentice Hall of India, 1995
4. Ashok Ambardar, Analog and Digital Signal Processing, Thomson Learning, second edition, 2001

5. B.P.Lathi, linear systems and signals Oxford University Press second Indian Impression, 2007
6. D.D. Shah & A.C. Bhagali, Signals and systems, MPH publication

Additional Reading:

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998
2. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prenice Hall, 1983.
3. R.A.Gabel,Signals and linear systems,John wiley and Sons.
4. chen,Signals and Systems Oxford University Press Third Indian Impression, 2007
5. I J Nagrath, S N Sharma, R Ranjan, and S Kumar , "Signals and Systms", Tata Mcgraw Hill

Suggested list of simulations

1. Generation and transformations of basic C.T. signals(2 simulations)
2. Verification of sampling theorem
3. Impulse and step response of a C.T. system
4. Demonstration of Fourier series coefficients
5. Demonstration of Fourier transform of signals
6. Demonstration of Laplace transform of signals
7. Finding Mean, variance and standard deviation of random data
8. State space to TF and TF to state space conversion

T.W. / Oral Examination:

Term work:

The term work shall consists of at least four assignments and six MATLAB or C simulations covering the whole of syllabus, duly recorded and graded. This will carry a weightage of fifteen marks. A test shall be conducted and will carry a weightage of ten marks.

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.

Theory Examination:

1 Question paper will be comprise of total 7 questions, each of 20 marks.

2. Only 5 questions need to be solved

Question number 1 will be compulsory and will cover all modules.

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.)

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

No question should be asked from pre-requisite module.

University of Mumbai

CLASS: T.E. (Electronics Engineering)		Semester - V	
SUBJECT: Microprocessors & Microcontrollers - I			
Periods per week (each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	3	25
	Oral Examination	-	-
	Term Work	-	25
	Total		150

Objective	Objective of this course is to introduce to the students the fundamentals of microprocessor and microcontroller. -	
Pre-requisite	Concept of Basic Electronics and Digital Logic Systems -	
Module	Contents	Hours
1	Basics of 8085: • Basic 8085 microprocessor architecture and its functional blocks, • 8085 microprocessor IC pin outs and signals, address, data and control buses, • 8085 features • Interrupt system of 8085 • Stack and subroutine • Types of memory and memory interfacing • Decoding techniques – absolute and partial • Mapping techniques – I / O mapped I / O and memory mapped I / O • Serial I/O lines of 8085 and the implementation asynchronous serial data communication using SOD and SID	8
2	Programming with 8085: • Basic instruction set, • Timing states, machine cycles and	9

	instruction cycles • Instruction Timing diagram and , interrupt process and timing diagram of interrupt instruction execution, • Writing assembly language programs, • Looping, counting and indexing operations related programs • Stacks and subroutines operations related programs • Conditional call and return instructions operations related programs • Debugging programs.	
3	Study and Interfacing of peripherals 8155, 8255, 8253/8254. 8259 with 8085	06
4	Basics of 8051: • Comparison of microprocessor and microcontroller, • Architecture and pin functions of 8051 chip controller, • CPU timing and machine cycles, • Internal memory organization, • Program counter and stack, • Input/output ports, • Counters and timers, • Serial data input and output • Interrupts. • Power saving modes	08
5	Programming with 8051: i. Instruction set. addressing modes, ii. immediate, registers, direct and indirect data movement and exchange instructions, iii. push and pop op-codes, iv. arithmetic and logic instructions, v. bit level operations, vi. jump and call instructions, vii. input/ output port programming, viii. programming timers, ix. asynchronous serial data communications. and x. hardware interrupt service routines.	9

	Interfacing of LCD display, hex keyboard, ADC0808, DAC0808 and Stepper motor with 8051 Current trends in microprocessors and practical implementation	
6	**Introduction to ARM Processor** 1. ARM family architecture, 2. Register architecture, 3. Memory Access and addressing modes, 4. Arithmetic and Logical Instructions, 5. Branching Instructions Comparative study of salient features of 8051 and its derivatives like 89C51, 89C52, 89C2051 AND 89C2052. Current processor and controller survey. (cost, availability, popularity)	8

Recommended Books:

1. Mazidi & Mazidi, The 8085 Microcontroller & Embedded system, using Assembly and C, 2nd edi, Pearson edu.
2. Microprocessors and Interfacing 8085, Douglas V Hall, Tata Mc Gram Hill
3. Microprocessor-Architecture, programming and application with 8085, Gaonkar, Penram International.
4. Crisp, Introduction To Microprocessors & Microcontrollers, 2e, Elsevier, 2007
5. ARM system-on-chip architecture, 2e, Pearson education,
6. Calcut,8051 Microcontrollers:An Applications Based Introduction, Elsevier
7. DV Kodavade, S Narvadkar, 8085-86 Microprocessors Architecture Progg and Interfaces, Wiley
8. Udayashankara V, Mallikarjunaswamy, 8051 Microcontroller, TMH
9. Han-Way Huang, Using The MCS-51 Microcontroller, Oxford University Press.
10. Ayala, 8051 Microcontroller , Cengage (Thomson)
11. Rout, 8085 Microprocessor, Cengage (Thomson)
12. The 8085 Microcontroller-Architecture, programming and application, 2nd edi, Penram International.

Suggested Practical list for TW

8085 Based (Max 02)

01) Addition and subtraction of two 8-bit numbers with programs based on different addressing modes of 8085A.
02) Addition and subtraction of two 16-bit numbers. (Using 2's complement method, also programs which access numbers from specified memory locations.)
03) Addition and subtraction of two 16-bit BCD numbers. (Using DAA instruction.)
04) Multiplication of two 8-bit numbers using the method of successive addition and Shift & add.
05) Division of two 8-bit numbers using the method of successive subtraction and shift & subtract.
06) Block transfer and block exchange of data bytes.
07) Finding the smallest and largest element in a block of data.
08) Arranging the elements of a block of data in ascending and descending order.
09) Converting 2 digit numbers to their equivalents.
a) BCD to HEX and b) HEX to BCD
10) Generating delays of different time intervals using delay subroutines and measurement of delay period on CRO using SOD pin of 8085A.
11) Generation of Fibonacci Series.

Application Based (Max 2)

01) Program controlled data transfer using 8255 PPI.
A) To INPUT data bytes from peripheral port and to store them in memory.
B) To OUTPUT data bytes from memory to peripheral port.
02) Study of interrupts by enabling them in main line program and then executing different subroutines when TRAP, RST 7.5, RST 6.5 & RST 5.5 are activated.
03) Interfacing 7 segment LED display using 8255A – in static and dynamic mode.
04) Interfacing ADC 0808/0809.
05) Interfacing DAC 0808.
06) Interfacing stepper motor with microprocessor using 8255A – in Half and Full excitation.
07) Interfacing a Centronics type printer.
08) Interfacing of Thumbwheel switches.
09) Interfacing of 8253 / 8254.

8051 experiments (Max 2)

1. Arithmetic operations
2. Packing and unpacking
3. Ascending and descending
4. 8051 timer based experiment

5. Transmission of character using RS 232 to PC(preferably on bread board)
6. 16 * 2 LCD and Hex keyboard interface (preferably on bread board)
7. ADC or DAC interface (any application) (preferably on bread board)

On latest:
Experiments are to be performed on Proteus VSM Plateform (Min 4)
To design and test circuits on

1. LED blinking,
2. 7segments display,
3. 16x2 multiple character LCD,
4. Run stepper motor/ DC motor,
5. Implement square wave,
6. Temperature display using
7. Demonstration of traffic lights,
8. Speed control of motor,

Using ARM Processor.

Practical/ Oral Examination:
Practical Examination will be based on experiments performed from the list of experiment given in the syllabus and the evaluation based on the same experiment.
Oral 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 ten 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.

Theory Examination:

1. Question paper will be comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and will cover all modules.
4. Remaining questions will be from same module or 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.

University of Mumbai

CLASS: T.E. (Electronics Engineering)		Semester - V	
SUBJECT: **Electromagnetic Engineering**			
Periods per week (each of 60 min.)	Lecture	03	
	Practical		
	Tutorial	01	
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical examination		
	Oral Examination		
	Term Work		25
	Total		125

Objective	Electromagnetic Field Theory deals with electric and magnetic field vectors, whereas circuit theory deals with voltages and currents that are the integrated effects of electric and magnetic fields. An understanding of Electromagnetics is a must to appreciate Wave Propagation, Antenna Theory, Microwave and Optical Fiber System.-
Pre-requisite	Vector Algebra

Module	Contents	Hours
1	**Basics of Electromagnetics** Co-ordinate systems, line, Surface & Volume Integral, Curl, Divergence & Gradient, Electric Charge, Coulomb's law, Charge distribution, Electric Field Intensity, field due to distributed charges, Electric Flux, Gauss's law, Divergence Theorem, Electric Potential & Potential Gradient, Ampere's Law, Magnetic Flux, Faraday's Law, Poisson & Laplace's Equations	**(06)**
2	**Maxwell Equations:** Formation of Maxwell's Equations Derivation of various basic electro magnetic laws using Maxwell's Equations, Conditions at Boundary Surfaces	**(06)**

	Electromagnetic Waves The wave equation for free space & conducting medium, Uniform Plane wave. Intrinsic Impedance, Helmoltz Equations. Propagation characteristics of Electromagnetic Wave. Polarization, Poynting's Theorem, Instantaneous, Average & Complex Poynting vector	(05)
	The uniform plane wave Propagation plane wave reflection and dispersion, reflection of uniform plane waves at normal incidence. standing wave ratio, wave reflections from multiple interfaces, plane wave propagation in general directions, plane wave reflection at oblique incidence angles, total reflection and total transmission of obliquely incident waves. wave propagation in dispersive media. pulse broadening in dispersive media.	(06)
	Transmission Lines Circuit representation of the parallel-plane transmission line, Transmission Line equations, Transmission Line parameters, Terminated Transmission line, Use of Smith Chart, Impedance matching techniques	(08)
	Radiation & Electromagnetic Interference (EMI) Potential Functions & the electromagnetic field, Potential functions for sinusoidal oscillations, The alternating current element (or Oscillating Electric Dipole), Power radiated by a current element& radiation resistance, EMI Sources, Effects of EMI, Need of EMC (Electromagnetic Compatibility), Electrostatic Discharge(ESD)	(05)

ext Books:

1. E. C. Jordan & K. G. Balmain-Electromagnetic Waves & Radiating Systems,2e, PHI, 1988.
2. G.S.N.Raju, Electromagnetic Field Theory and Transmission Lines, Pearson Education, 2e, 2008
3. R.K.Shevgaonkar, Electromagnetic Waves, Tata McGraw-Hill,2006

ditional Reading:

1. John D Krauss, Engineering Electromagnetics, McGraw-Hill, 6e. 2001.

2. Edminister, Engineering Electromagnetics, Schaum series, Tata McGraw-Hill, 2e, 1992.
3. Samuel Liao, Microwave Devices and Circuits ,Prentice Hall publication, 3e -1994
4. Edgar Hund., Microwave Communication Components & Circuits,Glencoe/ 3e,Mc-Graw- Hill
5. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, 6e, Pearson Education
6. Ashutosh Pramanik, Electromagnetism- Theory & Applications, PHI, 2e-2004
7. David K. Cheng, Field and Wave Electromagnetics, 2e,Pearson Education

Tutorials:

- At least eight tutorials based on the above syllabus out of which one tutorial should based on transmission line problems using Smith Chart only.
- Student shall write some simple Electromagnetic Fields Related simulation programs using MATLAB/SCILAB to demonstrate the applications of field theory.

Term-work:

A journal shall be consisting of solved problems in tutorials based on teachings in the lectures, in addition to assignments along-with some simple Electromagnetic Fields Related Simulation programs using MATLAB/SCILAB which will demonstrate the applications of field theory. A test based on the above contents shall be conducted and the test paper shall be attached to the journal as a part of term-work

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

Tutorials : 10 marks.

Test (at least one) : 10 marks

Attendance (Tutorials and Theory) : 05 marks.

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

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and will cover all modules.
4. Remaining questions will be from the same module or 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 the 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

University of Mumbai

CLASS: T.E. (Electronics Engineering)		Semester - V	
SUBJECT: Linear Integrated Circuit and Design			
Periods per week (each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	3	25
	Oral Examination	-	-
	Term Work	-	25
	Total		150

Objective	To teach the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals. Also to introduce a few special function integrated circuits such as Regulator ICS, Waveform generator etc.
Pre-requisite	Passive circuit analysis and transistor behavior. single or two stage amplifier, Diff-Amp and Current Mirror concepts

Module	Contents	Hours
1	**Operational Amplifier Fundamentals** • Basic Op Amp Configurations, • Ideal Op Amp Circuits Analysis, • Simplified Op Amp Circuits Diagram, • Input Bias and Offset Currents, • Low-Input-Bias-Current Op Amps, • Input Offset Voltage, • Low-Input-Offset-Voltage Op Amps, • Input Offset-Error Compensation, • Maximum Ratings. • Open-Loop Response, • Closed-Loop Response • Input and Output Impedances • Transient Response • Effect of Finite GBP on Integrator Circuits • Effect of Finite GBP on Filters • Current-Feedback Amplifiers	08

	• The Stability Problem, • Stability in Constant-GBP Op Amps Circuits, • Internal Frequency Compensation • External Frequency Compensation • Stability in CFA Circuits • Composite Amplifiers • Op Amp Powering. • Slew rate and methods of improving slew rate.	
2	**Linear Applications of OP-AMP** • Current shunt feedback (Inverting Amplifier) • Current Series feedback (Non-Inverting Amplifier) • Summing Amplifier, Averaging Amplifier • Difference Amplifier, • Instrumentation Applications, • Integrator/Differentiator using OP-AMP • Current-to-Voltage Converters, • Voltage-to-Currents Converters, • Grounded load V/I Converter • V-F and F-V Converters. • Sample-and-Hold Amplifiers	08
3	**Active Filter** • The Transfer function, • First-Order Active Filters, • Audio Filter Applications, • Standard Second- Order Responses, KRC Filters, • Multiple-Feedback Filters, • State-Variable and Biquad Filters, • Sensitivity, Filter approximations, • Cascade design, • Generalized impedance converters, • Direct design, • Switched capacitor filters.	08

4	**Non Linear Applications of OP-AMP** • Voltage Comparators • Comparator Application • Schmitt Triggers. • Precision Rectifier • Peak Detectors • Mono-shot Multi-vibrator • Astable Multi-vibrator • Triangular /saw-tooth waveform Generator	08
5	**Data Converters and Regulators** • Analog Switches • A-D Conversion Techniques • D-A Conversion Techniques • Integrated ICs employing above techniques and their applications • Functional block diagram of Voltage Regulators • Fixed voltage Regulators(78XX and 79XX) • Variable Voltage Regulators (LM317 and CA723)	10
6	**6.Waveform Generators and synthesizers** • Oscillators using OP-AMP (RC –Phase shift and Wien Bridge oscillators) • Monolithic Timer – NE555 • Phase-Locked Loops, Monolithic PLLs	6

Text Books:

1. Sergio Franco, Design with operational amplifiers and analog integrated circuits. Third edition, McGraw Hill International edition, 2002.
2. Ramakant A.Gayakwad, 'OP-AMP and Linear IC's', Prentice Hall / Pearson Education, 1994.
3. Robert Coughlin and F Driscoll, Operational Amplifiers and Linear Integrated circuits, sixth edition, Pearson Education Asia, 2001
4. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.

Additional Reading:

1. Donald A. Neamen, Electronic Circuit Analysis and Design, Second edition, McGraw Hill International edition 2001

2. James M. Fiore, Op Amps and Linear Integrated circuits, First reprint. Thomson Asia Pte. Ltd., 2001
3. K.R.Botkar, 'Integrated Circuits'. Khanna Publishers, 1996.

Suggested Practical list

Sr. No.	Topic	Experiments
1	Operational Amplifier Fundamentals	Determination of Slew Rate, CMRR and Frequency and offset voltage for IC 741 Op-amp.
2	Linear Applications of OP-AMP	Design and implementation of linear equation for op-amp i.e. $V_o = V_1 + V_2 - V_3$ using IC 741
3	Active Filter	Frequency response of Integrator/ differentiator using simulation Program on SPICE
4		Frequency Response of 2nd order HPF filter on SPICE
5		Frequency Response of 2nd order LPF using SPICE
6	Non Linear Applications of OP-AMP	Design of Schmitt Trigger using IC 741 for designed value of UTP and LTP
7		Design of mono-stable Multi-vibrator for required pulse width using IC 741
8		Design of Astable multi-vibrator for required frequency and Duty cycle using IC 741
9		Design of triangular/ Saw-tooth wave form generator using IC 741
10	Data Converters and Regulators	Design of R/2R ladder 4-bit D/A Converter using IC 741
11		Design FLASH TYPE 2-bit A/D converter using LM 324
12		Design of LOW / HIGH Voltage Regulator using IC 723
13	Waveform Generators and synthesizers	Design RC oscillators for required frequency and verify it using SPICE code
14		Design of mono-stable Multi-vibrator for required pulse width using IC 555
15		Design of Astable multi-vibrator for required frequency and Duty cycle using IC 555
16		Verify IC 565 as Frequency Demodulator
17		Verify working of waveform generator ICL 8038

Practical/ Oral Examination:

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

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

Termwork:

The term-work shall consist of at least six laboratory experiments covering the whole of syllabus, duly recorded and graded as well as at least four computer simulations using EDA tools like PSPICE duly recorded and graded. This will carry a weightage of Ten marks. A test shall be conducted and will carry a weightage of ten marks.

The distribution of marks for term work shall be as follows

Laboratory work (Experiments and Journal) : 15 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.

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and will cover all modules.
4. Remaining questions will be from the same module or 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 the 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

University of Mumbai

CLASS: T.E. (Electronics Engineering)		Semester - V
SUBJECT: Digital Communication and Coding Techniques		
Periods per week (1 Period of 60 min.)	Lecture	4
	Practical	2
	Tutorial	-

		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination		
	Oral Examination	-	25
	Term Work	-	25
	Total		150

Objective	The increase in demand for data transmission coupled with the availability of wideband communication channels and sophisticated integrated circuits have led to the development of efficient and reliable digital communication systems. This course emphasizes impact of the channel limitations and characteristics on data transmission using digital data.
Pre-requisite	Concepts of basic communication techniques - Modulation and Demodulation, Sampling, Fourier Transform

Module	Contents	Hours
	Concept of Probability Theory in communication systems Random variables, Mean and Variance of Random variables and sum of random variables Useful PDFs & CDFs : Gaussian , Rayleigh pdf & Rician Distribution , Binomial and Poisson Distributions, Central-Limit Theorem.	03
	Information Theory and Source Coding Measure of Information, Entropy, Information rate, Channel capacity, Capacity of a Gaussian channel, Bandwidth - S/N trade-off, Source	

	coding theorem, Coding to increase the average information per bit - Huffman coding, Lempel Ziv coding. Examples and application of source coding.	
	Error Control Codes Channel coding theorem. Rationale for coding and types of codes, Discrete memoryless channel , some Algebraic concepts - code efficiency and Hamming bound , linear block codes, Cyclic codes, Convolutional codes , Code tree, state and Trellis diagram. Decoding of convolutional codes using Viterbi algorithm.	13
	Pulse Shaping for optimum transmission Concept of Inter channel and Inter symbol Interference, Eye Pattern, Nyquist's Criterion for distortion less Baseband Binary Transmission, Correlative Coding.	06
	Digital Modulation Techniques Digital Modulation formats , coherent and non modulation. Digital modulation techniques- BPSK, Modifications of BPSK, QPSK,M-ary PSK,ASK, QAM, BFSK, M-ary FSK and MSK – Transmitter- Receiever, Power spectra, Bandwidth efficiency, Euclidian distance. Integrate and dump receiver, Matched filter, correlator. The optimum Receiver.	15
	Spread Spectrum Modulation Spread Spectrum Modulation –Pseudo noise Sequences, Processing Gain and Jamming Margin, Direct-sequence spread spectrum, Frequency –hop Spread Spectrum. Application of spread spectrum : DS-CDMA	06

ext Books:

1. Simon Haykin- Communication Syatem, , John Wiley and sons
2. Taub Schilling & Saha - Principles of communication systems - Tata McGraw Hill, Third edition.
3. Bernad Sklar,-Digital Communication, Pearson Education , 2nd ed
4. Amitabha Bhattacharya,-Digital communication , Tata McGraw Hill
5. Lan A. Glover, Peter M. Grant -Digital Communications, Pearson education, Second edition.
6. Simon Haykin Digital communication, John Wiley and sons

eference Books:

7. John G. Proakis,- Digital Communications, McGraw Hill , 5th ed
8. William D. Stanley & John m. Jeffords, Electronic Communications Principles and Systems, Cengage Learning.
9. Lathi B.P.,- Modern Digital and Analog communications systems - PRISM Indian edition
10. PROAKIS & SALEHI - Communication system engineering, Pearson Education

roposed Practical list

1. BPSK
2. QPSK
3. BFSK
4. QASK
5. BER calculation for a digital communication system
6. Huffman coding
7. Lempel Ziv coding
8. Linear Block code - Code generation, d_{min}, syndrome.
9. Cyclic Code - Systematic and non-systematic code generation, syndrome.
10. Convolution Code – code generation from generator sequences
11. Direct sequence spread spectrum

V. / Oral Examination:

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

Term Work:

Term work shall consist of minimum eight experiments, Two Assignments 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 o laboratory work and minimum passing in the term-work.

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and will cover all modules.
4. Remaining questions will be from the same module or 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 the 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

University of Mumbai			
CLASS: T.E. Electronics Engineering		Semester - V	
SUBJECT: Environmental Studies			
Periods per week (each of 60 min.)	Lecture	2	
	Practical	-	
	Tutorial	1*	
Evaluation System		Hours	Marks
	Theory Examination	2	50
	Practical examination	-	-
	Oral Examination	-	-
	Term Work	-	25
	Total		**75**
*Class wise Tutorial			

Objective: This course is to create environmental awareness, of variety of environmental concerns.

Module	Contents	Hrs
1	The Multidisciplinary nature of environmental studies Definition, scope and importance Need for public awareness	1
2	Natural resources Renewable and non-renewable resources Natural resources & associated problem. a. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. b. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d. Food resources: World food problems overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	4
3	• Ecosystems • Concepts of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem.	3