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

SEMESTER: VII

Sr. No	Subjects	No. of periods of 1Hour		Duration of Theory Paper in Hours	Marks			
		Lecture	Practical		Theory Paper	Term Work	Oral	Total
1	VLSI Design	4	2	3	100	25	25	150
2	Filter Design	4	2	3	100	25	25	150
3	Power Electronics and Drives	4	2	3	100	25	25	150
4	Communication Networks	4	2	3	100	25	25	150
5	**Elective-II** 1. Wireless communication 2. Advances in Biomedical Instrumentation 3. Micro computer system design 4. Digital Image Processing Design	4	2	3	100	25	25	150
6	**Project -I**		4			25	25	50
TOTAL		20	14	15	500	150	150	**800**

SEMESTER: VIII

Sr. No	Subjects	No. of periods of 1Hour		Duration of Theory Paper in Hours	Marks			
		Lecture	Practical		Theory Paper	Term Work	Oral	Total
1	Advance VLSI Design	4	2	3	100	25	25	150
2	Robotics and Automation	4	2	3	100	25	25	150
3	Embedded Systems and Real-Time Programming	4	2	3	100	25	25	150
4	**Elective-III** 1. Advanced Networking Technologies 2. DSP Processors and architectures 3. Neural Networks & Fuzzy Systems 4. Electronics Product Design	4	2	3	100	25	25	150
5	**Project -II**		8	--		50	100	150
TOTAL		16	16	12	400	150	200	**750**

University of Mumbai

CLASS: B.E. (Electronics Engineering)		Semester - VII	
SUBJECT: VLSI Design			
Periods per week	**Lecture**	**04**	
	Practical	**02**	
(each 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 familiarize students with the different aspects of the VLSI field and to introduce important concepts that have industry value	**-**
Pre-requisite	Digital System Design I and II, BEC	**-**
1. Introduction to VLSI	Evolution of logical complexity in ICs as a function of time, VLSI design flow, Y-chart representation, design hierarchy/design abstraction levels in digital circuits, concepts of regularity, modularity and locality, Semi-custom & full custom devices	03
2. Physics of MOSFET	MOS capacitor, energy band diagrams, band bending, flat band voltage, threshold voltage calculation, threshold adjustment, MOSFET linear and saturated operation(GCA), MOSFET capacitance, channel length modulation. Types of scaling, functional limitations of scaling, short channel, narrow channel effects, hot electron effects.	13
3. Semiconductor manufacturing process	Wafer processing, mask generation, oxidation, epitaxy, ion implantation, diffusion, metallization, photolithography, process steps for NMOS & PMOS devices, CMOS inverters, latch-up in CMOS and its prevention. Process simulation using CAD tools Video of manufacturing process to be shown.	03
4.Design rules and layout	Need of design rules, NMOS, PMOS and CMOS design rules and layouts. Design of NMOS and CMOS Inverter, NAND and NOR gates. Interlayer contacts, Butting and Buried contacts. Stick diagrams, layout of integrated circuits. Realization of Boolean expressions in CMOS. Use of CAD tools for layout design and simulation.	10

5.MOS Inverters	MOS inverters - resistive load - NMOS load - pseudo NMOS (Qualitative) and CMOS inverters (quantitative) -calculation of noise margin, calculation of rise, fall and delay times for CMOS inverter, transistor sizing and power dissipation , series and parallel equivalency rules, equivalent inverter (numericals on noise margin calculations, timing calculations, power dissipation, equivalency expected)	12
6. Verilog	Basic concepts, structural gate level, switch level, behavior and RTL modeling. Arithmetic Circuits in CMOS VLSI – carry look ahead adder, high speed adders, subtractors, decoders, multiplexer and multipliers. Sequential circuits' implementation using verilog (Flip-Flop, registers and counters, state machines).	07

Text Books:

1. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits - Analysis & Design, Second Ed., MGH

2. Jan M Rabaey, Digital Integrated Circuits - A Design Perspective, Prentice Hall

3. *Fabricius*, Eugene D, Introduction to VlSI Design. TMH

4. . Samir Palnitkar, Verilog HDL, A Guide to Digital Design and Synthesis, Pearson Education.

Reference Books:

1. . Neil H.E. Weste, Kamran Eshraghian, *Principles of CMOS VLSI Design: A* system perspective, Addison Wesley publication.

2. Fundamentals of Modern VLSI Devices by Yuan Taur, Cambridge University Press

Proposed Practical list

Suggested list of experiments using CAD tools such as Magic, Microwind, Tanner tools, Xilinx ISE etc.

1. Spice simulation of NMOS(resistive load, enhancement load, depletion load) inverters, CMOS inverters
2. Fabrication process simulation using CAD tool
3. Layout design and simulation ,using CAD tools, of the following

    1. CMOS Inverter
    2. NAND/NOR gates
    3. Boolean expressions
    4. Mux/Decoder
    5. Logic expression using pass transistor/ transmission gate
    6. 6T RAM cell
4. Simulation and synthesis of Verilog code for
    1. Adder/subtractor
    2. Mux/decoder
    3. flip-flop/counters
    4. State machines

Term work:

The term work should contain at least 7 CAD programs and 2 assignments covering the whole syllabus, duly recorded and graded.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

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

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: B.E. (Electronics Engineering)		**Semester - VII**	
SUBJECT: Filter Design			
Periods per week (each 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	Filter is an important part of any electronic system. This course is to introduce the student the design of analog and digital filters ,adaptive filters and multirate signal processing	
Pre-requisite	Continuous and Discrete time signals and systems	
Module	**Contents**	**Hours**
1	**Analog filters** Filter specifications, Introduction to Butterworth Chebyshev, design (Derivation of T.F.), Elliptical filters, Frequency Transformations Low pass, high pass and band pass active filter realization, infinite gain single amplifier (LP,BP & HP) , positive and negative feedback infinite gain single amplifier filters, high order filters.	10
2	**Direct realization methods:** Active network elements for direct realization, inductance simulation frequency dependent negative resistors, leapfrog realization techniques, primary resonator block, switched capacitor filters.	10
3	**IIR filter design** IIR filter design methodology, Design of Butterworth and Chebyshev filters using Impulse/step invariant method, matched Z Transform method, Bilinear transform Technique. Spectral transformations Filter design by pole zero placements.	6
4	**FIR filter : Analysis and design** Linear phase FIR filter and its types, FIR filter design using windows and Frequency sampling method, Half Band FIR filter design.	6
5	**Adaptive Filters:** Concept of adaptive filter ,MMSE criterion ,LMS and RLS algorithms ,Basic Weiner filter and its applications	8
6	**Multirate Digital signal Processing** Concepts Decimation Interpolation ,sampling rate conversion by raional factor, polyphase structures ,multistage implementation ,applications like subband coding and Quadrature mirror filtering.	8

Text- Books:

- Principles of Active network synthesis and design: Govind Daryayani John Wiley publication
- Active and passive analoig filter design- Lawrence P Huelson Tata- Mc-Grawhill publication
- E.C.Ifeachor and B.W Jervis,Digital Signal Processing A Practical approach, Pearson Publication,second edition
- Ashok Ambardar, Digital Signal Processing, Cengeg Learning Publication,.

- J.G. Proakis, D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and applications, Prentice Hall of India, 1995
- A.V. Oppenheim, Ronald W Schafer, Prentice Hall, 1983.
- A.Antoniou, Digital Filter analysis and applications. Tata McGraw-Hill Publication.
- Siman Hykin, Adaptive filters, PHI Publications
- S,Salivahanan, A. Vllaraja, C.Ganapriya Digital signal processing ,Mc Graw Hill ,second edition
- P.P.Vaidyanathan Multirate systems and Filter Banks Prentice Hall of india 2006
- Digital signal processing :system analysis and design .Diniz ,da sillva, Netto Cambridge university press

Reference Books:

- B.P.Lathi, linear systems and signals Oxford University Press second Indian Impression, 20007.
- S.K. Mitra, Digital Signal Processing, Tata McGraw-Hill Publication, 2001
- Chi-tsong Chen Digital signal processing, Oxford University Press
- P.P.Vaidyanathan Multirate systems and Filter Banks Prentice Hall of india 2006
- Digital signal processing:fundamentals and applications Li Tan Acadamic press

Suggested list of simulations
Matlab or C/C++ or Labview:

1. Analysis of analog filters in frequency domain
2. IIR filter design : Impulse invariant and Bilinear transform method
3. Linear phase filters: comparison of various types
4. FIR design using windows
5. FIR design using frequency sampling
6. Effect of quantization on filter design
7. Introduction to FTA tool for filter design
8. Application of adaptive signal processing to practical one dimensional signal e.g. speech signal ,ECG signal, music signal etc
9. Implementation of interpolation and decimation operation
10. implementation of filter on DSP processor

Term Work:

The term work shall consist of at least **two numerical assignments and six MATLAB Or C/C++ or Labview simulations** covering the whole of syllabus, duly recorded and graded.
The distribution of marks for term work shall be as follows:

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

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

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 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: B.E. (Electronics Engineering)		**Semester - VII**	
SUBJECT: Power Electronics and Drives			
Periods per week	**Lecture**	**4**	
	Practical	**2**	
(each of 60 min.)	**Tutorial**	**-**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**3**	**100**
	Practical /Oral examination		
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**150**

Objective	To teach the applications of power electronics devices. Also to study Industrial Drives.	
Pre-requisite	Power Semiconductor devices, AC and DC machines	
Module	**Contents**	**Hours**
1	**Phase Controlled Converter:** Single phase bridge converter with effect of source impedance. Dual converter.	04
2	**Chopper:** Principle of chopper operation, step –up and step – down, one quadrant, two quadrant chopper (Type A and B). Thyristorised chopper circuits a) Voltage commutated chopper b) Current commutated chopper c) Load commutated chopper	10
3	**Inverter:** Classification of inverter , Analysis & Design: a) Series , Parallel and bridge (Mc Murray) b) Voltage and current source inverter c) PWM inverter Different methods for harmonic reduction in inverter output.	12
4	**DC Drives:** Concept of DC electric drive with respect to speed control. Single phase, half wave semi converter, full converter drive for separately excited dc motor. Dynamic and regenerative braking of DC motor. Methods used to adjust following parameters of a typical dc drive. 1) Speed 2) IR compensation 3) current limit 4) acceleration/de-acceleration	08
5	**AC Drives**: Induction motor fundamentals and speed control methods 1. Stator voltage 2. Variable frequency 3. Rotor resistance 4. Slip energy recovery scheme Drives related to V/F control and slip power recovery scheme.	08
6	**Applications:** SMPS and UPS:- Analysis of fly back, forward and half bridge converters	06

	for SMPS. Block diagram and configuration of UPS, salient features, selection of battery and charger ratings and sizing of UPS	

Text Books:

1) General Electric: SCR manual, USA.
2) M.H. Rashid, Power electronics, PHI India.
3) M.D. Singh and K.B. Khanchandani, power electronics, Tata McGraw Hill
4) Dr. P.S. Bimbhra, Power Electronics, Khanna Publications.
5) shepherd, Hulley, Liang power electronics and motor control second edition, Cambridge

Additional Reading:

1)Chute and Chute: Electronics in Industry; MGH
2)B.W. Williams: Power Electronics, Jhon Willey,1975.
3) P.C. Sen , Power Electronics, TMH.

Suggested Laboratory Experiments

Minimum Six experiments on

- Various types of Inverters
- Various types of Choppers
- Speed Control of DC Motor and Induction Motor

Term work:

Term work shall consist of minimum six experiments, Two Assignments and a written test.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

Oral Examination:

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

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: B.E. (Electronics Engineering)		**Semester – VII**	
SUBJECT: Communication Networks			
Periods per week (Each 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

Objectives:

Interconnecting hardware, configuring network systems, measuring performance, observing protocols in action, and creating client-server programs that communicate over a network all help sharpen students's understanding and appreciation.

Module	Contents	Hours
1	**Introduction to Communication Networks** Communications Model, Data Communication Networks- Public Switched Telephone Network (PSTN), Leased Line, Local Area Networks (LAN), Public Switched Data Network (PSDN), and Integrated Services Digital Network (ISDN). Communication Architectures, Protocol Layer Concepts, OSI Layer, Standard Organizations. Transmission Media**:** Twisted pair, STP, UTP, Coaxial cable, Fiber Optics, Wireless, Microwave, Satellite, Radio, and Media Properties.	**06**
2	**Data Transmission and Digital Carrier Systems** Simplex, Half-Duplex, Full-Duplex, Serial and Parallel Transmission, Synchronous and	**08**

	Asynchronous Transmission, Bit Oriented Synchronous Transmission, Byte Oriented Synchronous. Modem functions, Standard V Series. **Digital Carrier Systems:** T-carrier, Super frame, Extended Superframe, (ESF), XDSL. E-carrier, PDH, Synchonouse Digital Hierarchy, Synchronous Optical Network, concept of SONET/SDH, and Digital Multiplexing Hierarchy,	
3	**Data Link Control** Flow Control, Framing, Sliding-Window, Error Detection, Parity Check, Cyclic Redundant Check (CRC), Error Control Techniques, Stop-and-Wait ARQ, Go-back-N ARQ, Selective-repeat ARQ. HDLC Frame Format .	**08**
4	**Switching Network** Switching technology, Circuit switching, Packet switching, Virtual Circuits and Datagram. Routing in Packet Networks, Network Algorithms and Shortest Path Routing, Congestion Control in Switched Data Networks.	**08**
5	**Local Area Networks and High-Speed LANs** LAN characteristics, Topology, Bus, Ring, Star, LAN Media, Data Link Layers, MAC Address, Logical Link Control, LAN Standard, IEEE 802.2, IEEE 802.3- CSMA/CD, CSMA/CA Ethernet architecture, IEEE 802.3 specifications, Hub, 10Base5, 10Base5, 10BaseT, 10BaseF, Concept of bridge LAN., Ethernet Frame, Binary Back off, Inter-frame Gap, Ethernet Performance, Ethernet Switching. IEEE 802.4, IEEE 802.5, Gigabit Ethernet and FDDI .	**10**
6	**Applications and Layered Architectures** Examples of Protocols, Services (HTTP, DNS and SMTP etc), and Layering, TCP/IP Architecture. TCP/IP Protocol, IP Addressing, The Berkeley API, Application Layer Protocols and TCP/IP Utilities	**08**

Text Books:

1. William Stallings, Data Computer Communications, Pearson Education
2. A. Leon-Garcia and Indra Widjaja, Communication Networks, Tata McGraw-Hill Publication
3. Behrouz A Forouzan, Data communications and Networking 4th Edition, McGraw-Hill Publication.
4. J. F. Kurose and K. W. Ross, Computer Networking, Pearson Education
5. D. Bertsekas and Gallager, Data Networks, 2nd Edition, Prentice-Hall of India

Reference Books:

1. Gerd Keiser, Local Area Networks, McGraw-Hill Publication.

2. Dayanand Ambawade and Deven Shah, Linux Lab, Wiley-Dreamtech Publication.
3. Behrouz A Forouzan, Local Area Network 4th Edition, McGraw-Hill Publication
4. Youlu Zheng, Networks for computer scientists and engineers OXFORD Publication
5. Natalia olifer Victor olifer, Computer Networks Wiley- Publication

Proposed Practical list:

1. Study of Hardware and Software Components of Computer Communication and Networking
2. Network Installation & Configuration of Network OS : ***GNU/Linux***
3. IP Networking & Network Commands: *ifconfig , ping, traceroute , netstat, arp ,nslookup dig & route etc.*
4. Study of Modem Commands, Queries
5. Study of Serial Communication (RS-232)
6. Study of Network topology and flow control techniques.
7. Simulation of Shortest path routing algorithms.
8. Installation and Configuration of Telnet & FTP Server/Client
9. Installation and Configuration of DNS & Web Server/Client
10. Network Protocol Analyzers : *TCPDUMP & ETHEREAL*
11. Implementation of CSMA/CD and Stop-n-Wait Protocols using Network Simulator (ns-2)
12. Study of Wireless LAN *(WLAN): Adhoc & Infrastructure Network* Mode
13. Implementation of Socket Programming

Term work:

Term work shall consist of minimum six experiments, 2 Assignments and a written test.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

Oral Examination:

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

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: B.E. (Electronics Engineering)		**Semester – VII (Elective)**	
SUBJECT: WIRELESS COMMUNICATION (Elective)			
Periods per week (each 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**

Module	Contents	Hours
Objective	The objective of the course is to introduce the Concepts of basic wireless mobile communication systems.	-
Pre-requisite	Fundamentals of Digital Communication	-
1	**Introduction and Cellular Concept** Existing technology, Evolution in wireless systems, Trends in cellular system Frequency Reuse channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Cellular System, Design in worst case with an omni Directional Antenna, Co-Channel Interference Reduction with use of Directional Antenna, Improving Coverage and Capacity in Cellular systems, Trunking and Grade of service	08
2	**WIRELESS COMMUNIACTION SYSTEMS GSM** GS Services and features , GSM Architecture and interfaces, GSM Radio Sub System , GSM Channel Types , Traffic Channels, Control Channels, Example of a GSM call, Frame structure for GSM , Signal Processing in GSM, GPRS.	10
3	**Wideband Modulation Techniques –OFDM** Basic Principles ,OFDM Signal Mathematical	12

	representation , Block Diagram , Selection Parameters for modulation , Pulse shaping, Windowing, Spectral Efficiency , Synchronization	
4	**WIRELESS COMMUNIACTION SYSTEMS CDMA IS95** **Direct** sequence Spread Spectrum , Spreading codes, Multipath Signal Propagation and RAKE receiver, Frame Quality and BER Requirements, Critical challenges of CDMA,TIA IS95 System, Physical and Logical Channels of IS95, CDMA IS95 call processing, soft hand off and power control in CDMA,Access and Paging Channel Capacity, Reverse and Forward Link Capacity of a CDMA System.	08
5	**WIRELESS COMMUNIACTION SYSTEMS** **CDMA 2000** : CDMA layering structure, CDMA 2000 channels, logical channels , forward link physical ,forward link features ,reverse physical channels , CDMA 2000 Media Access control and LAC sub layer, Data services , Data services in CDMA 2000 , mapping of logical channels to physicals, evolution of CDMA IS95 to CDMA 2000.	10
6	**More WIRELESS COMMUNIACTION SYSTEMS** Bluetooth , Wi Fi Standards, WIMAX, Wireless Sensor Networks, Zigbee , UWB, IEEE 802.20 and Beyond.	04

Text Books:

1) Wireless Communication : Principles and Practice – Theodare . S. Rappaport- Pearson Education
2) Wireless Communication :- Upena Dalal – Oxford Higher Education
3) Wireless Network Evolution : 2G to 3G – Vijay . K. Garg – Pearson Education

Additional Reading:

1) Principles and Application of GSM – Vijay Garg , Joseph . E. Wilkes – Pearson Education
2) Mobile Cellular Telecommunications : Analog and Digital Systems , William C. Y. Lee, Tata McGraw – Hill Edition
3) Introduction to Wireless Telecommunication Systems and Networks- Gary . J. Mullet, DELMAR CENGAGE Learning
4) Wireless Communications and Networks : 3G and Beyond, ITI Saha Misra, Tata McGraw – Hill Edition
5) Fundamentals of Wireless Communication: David Tse, Pramod Viswanath, CAMBRIDGE University Press
6) Mobile Wireless communications, Mischa Schwartz, CAMBRIDGE University Press

7) Wireless Communications : Andreas F. Molisch , Wiley Student Edition

Proposed Practical list

Hardware setups or simulation experiments on the following

1. OFDM (2 expts),
2. GSM (2 expts),
3. CDMA (2 expts),
4. One seminar per student on related latest technology in wireless systems (outside syllabus)

Term work:

Term work shall consist of minimum six experiments, Two Assignments and a written test.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

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

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: B.E. (Electronics Engineering)	**Semester – VII (Elective)**
SUBJECT: Advances in Biomedical Instrumentation (Elective)	

Periods per week (each 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**

Module	**Contents**	**Hours**
Objective	To understand .importance of pathological and diagnostic equipments in Medical Electronics. The material and working of prosthetic and intensive care unit. Different imaging techniques in detail and Drug Delivery and Hospital Information System	
Pre-requisite	Knowledge of generation of electrical signal after studying anatomy and physiology of human body and different systems. Basic working and design of biomedical instruments.	
1	**Basic principle of Photometry :** • Beer Lambertz's Law, • Photoelectric Colorimeter • Spectrophotometer • Flame photometer • Autoanalyzer	06
2	**Blood Gas Analyzers:** Blood PO2, PCO2 and PH measurement; Complete Blood Gas Analyzer; Blood cell Counter : ▪ Methods of Cell counting-Coulter Counters; ▪ Automatic recognition and ▪ Differential counting of cells.	08
3	**Foetal Monitoring Instruments:** • Cardiotocograph • Foetal heart rate measurements • Foetal scalp pH monitoring	06
4	**Orthotic and Prosthetic Engg.** Definition, Need and Classification Normal Human Locomotion – Gait Cycle Biomaterials : Definition, Need and Classification Biological Testing and Biocompatibility Upper and Lower limb Prosthetic devices Upper and Lower limb Orthotic devices Study of various biomaterials and applications • Metallic Implants • Composites • Ceramics • Polymers Heart Lung Bypass machine and artificial heart valves	10

5	**Fundamentals of medical imaging:** X-ray computed Tomography, Spiral or Helical C T: Slip Ring Technology, C T Angiography. Clinical use & Biological effects and safety, Magnetic resonance imaging Biological effects and safety. Nuclear medical imaging Biological effects and safety., Infrared imaging, Liquid crystal thermography. Microwave thermography. Endoscopy, gastroscope, bronchoscope, cystoscope, colonoscope, Enteroscope Lithotripsy.	10
6	**Advances in Biomedical Systems:** Introduction to Nanotechnology and its use in Drug Delivery System, Hospital Information system: Role of database in HIS. Need of Networking in HIS. Overview of Networking, topologies and its configuration. Structuring medical record to carry out functions like admissions, discharges, treatment history etc. Computerization in pharmacy & billing. Automated clinical laboratory systems & radiology information system.	08

Text Books:

1. Khandpur R. S., Handbook of Biomedical Instrumentation, Tata McGraw Hill, second edition, 2003
2. Carr and Brown, Introduction to biomedical equipment technology, fourth edition, Pearson press, 2003
3. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.
4. W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (3rd eds), Mosbey Year-Book, Inc., 1992.

Reference Books:

1. John G. Webster, Bioinstrumentation John Wiley and sons,2004
2. Joseph Bronzino (Editor-in-Chief), Handbook of Biomedical Engineering, CRC Press, 1995.
3. Neelina Malsch , Biomedical nanotechnology by CRC press release, Malsch TechnoValuation, Utrecht, The Netherlands
4. L.A.Geddes and L.E.Baker,"Principles of Applied Bio-Medical Instrumentation" John Wiley & Sons 1975.
5. Khandpur R S, Handbook of Analytical Instrumentation, Tata Mc Graw Hill
6. Harold E. Smalley, "Hospital Management Engineering – A guide to the improvement of hospital management system", PHI. C. A. Caceras ,"Clinical Engineering"

Proposed Practical list

Sr.no	Topic	Title of Experiment
1	Basic principle of Photometry /Analyzer	Experiment based on any analyzer
2	Monitors	PH Meter
3		FHR (Foetus Heart Rate Monitor)
4	Orthotic and	Prosthetic Limb

5	Prosthetic Engg.	Heart Lung Machine or any other Prosthetic unit
6	Medical Imaging	Experiment to demonstrate imaging based on different Principles
7		
8	HIS	Demonstration of S/W used for hospital Information System

Termwork:

The term-work shall consist of at least six laboratory experiments covering the whole of syllabus, duly recorded and graded.

The distribution of marks for term work shall be as follows,
Laboratory work (Experiments and Journal) : 15 marks.
Test (at least one) : 10 marks.

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

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

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 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: B.E. (Electronics Engineering)		**Semester – VII (Elective)**	
SUBJECT: Elective - Microcomputer System Design			
Periods per week (each of 60 min.)	**Lecture**	**4**	
	Practical	**2**	
	Tutorial	**-**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**3**	**100**

	Practical /Oral examination		
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**150**

Module	**Objectives: To understand the architecture and functioning of Pentium processor, its peripherals and interfacing.**	
	Pre-requisite: Fundamentals of Microprocessor	
	Contents	**Hours**
1	**The Pentium Processor** Detail discussion of Pentium architecture and functional units: super scalar architecture, dual pipe line , Integer pipeline stages, Floating point instruction stages, Overview of on chip code Maintaining coherency in on-chip cache MESI protocol Write once policy Study of Pentium signal interface, interface with various devices, misaligned data transfers data bus steering for 32, 16 and 8 bit devices	08
2	**The Pentium Processor** Code cache organization, split line access Branch Prediction logic, Instruction pairing rules Data Cache organization, detail discussion with various situations of U and V pipeline accesses Burst bus cycles, cache line fills, single transfer cycles pipelined cycles, special cycles. Interrupt acknowledge bus cycle, bus cycle state machine, bus and bus state transition. System management mode Interrupts, reliability and error reporting	10
3	Advanced features of Pentium II , Pentium Pro , Pentium IV Out of order execution , Advanced Branch Prediction, Hyper threading , On chip Level 2 cache , Trace cache .	06
4	**PCI bus :** Introduction to local bus , Need for standard bus PCI signal interface: Functional grouping of signals, their role in transactions PCI Bus arbitration , Hidden Bus Arbitration , Bus Access Latency Situations when master or target dominates the bus PCI read write commands Interrupt handling in PCI, Interrupt Routing and Chaining Need for the configuration space and its usage	10
5	**Peripheral Bus Interfaces** Basic hard disk structure IDE interface signals ,Timing Specifications, IDE	08

	register model, IDE protocols, commands SCSI Bus hardware , Phases in transactions, Commands and protocols	
6	**Universal Synchronous Bus(USB) :** Introduction to USB, PC requirements, Bus topology, understanding the host and the peripheral, the development process. USB transfer basics, Elements of a transfer, successful transfers. Transfer types, Control transfer, Bulk transfer, Interrupt transfer, Isochronous transfer, time critical transfers.	06

Text Books:

1) Tom Shanley et al, Pentium Processor System Architecture , Addison Wesley Press
2) Tom Shanley et al , PCI System Architecture , Addison Wesley Pres
3) F. Schmidt , SCSI Bus and IDE Interface , Addison Wesley Press
4) Jan Axelson , USB Complete , Pentium Publication , Second Edition

Reference Books:

1) Tom Shanley et al, Protected Mode Architecture, Addison Wesley Press

Suggested Laboratory Experiments

Minimum six experiments on

- Use of CPUID instruction and identification of Processor
- Various uses of DOS interrupts
- PCI BIOS

And assignments /experiments covering other topics of syllabus

Oral Examination:

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 Six experiments, assignments and a written test.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

Oral Examination:

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

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: B.E. (Electronics Engineering)		**Semester – VII(Elective)**	
SUBJECT: Digital Image Processing			
Periods per week	**Lecture**	**04**	
	Practical	**02**	
(each of 60 min.)	**Tutorial**	**-**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**03**	**100**
	Practical examination		
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**150**

Objective	Image processing has grown considerably due to fast computational systems. Many important real life applications in diverse fields are therefore possible. This first course in image processing shall teach basic concepts in the subject.
Pre-requisite	Continuous and Discrete time signals and systems

Module	Contents	Hours
1	**Digital Image Fundamentals** Introduction, components of image processing systems, Image sensing & acquisition, Image sampling & Quantization, Pixel operation,	4
2	**Image Enhancement** Gray Level Transformations, Histogram Processing, Spatial Filtering, Smoothing and Sharpening Filters. Homomorphic Filtering Colour Image Enhancement.	8
3	**Image Segmentation** Detection of Discontinuities, Edge linking & Boundary Detection, Thresholding, Region based segmentation Laplacian of Gaussian, Derivative of Gaussian, Canny Edge Detection, Morphological operation : Dilation erosion, Opening & Closing, Basic	12

	Morphological Algorithm, Image representation schemes.	
4	**Image Transform** Discrete Fourier transform, Walsh transform(WT), Hadamard transform, Cosine transform, Haar transform, Wavelet transform,	8
5	**Image Compression** Fundamentals ,Lossless compression : RLE, Arithmetic Coding, Huffman Coding, ,Lossy compression : JPEG,MPEG, Subband Coding, Vector quantization, Image & Video compression standard.	10
6	**Applications of Image Processing** Case Study on Digital Watermarking, Biometric Authentication (Face, Finger Print, Signature Recognition), Vehicle Number Plate Detection and Recognition, Object Detection using Correlation Principle, Person Tracking using DWT, Handwritten and Printed Character Recognition, Contend Based Image Retrieval, Text Compression.	6

Text- Books:

1. Gonzalez & Woods, Digital Image Processing, Pearson Education, Second edition.
2. W. Pratt, Digital Image Processing, Wiley Publication, third edition, 2002.
3. S.Jayaraman Digital Image Processing TMH (Mc Graw Hill) publication
4. Milin Sonaka , Digital Image Processing and computer vision cengage learning, Thomson publication second edition.2007.
5. A.K. Jain, Fundamentals of Image processing, Prentice Hall of India Publication, 1995
6. Gonzalez & Woods, Digital Image Processing using MATLAB, Pearson Education

Reference Books:

1.Mc Andrew ,Introduction to Digital Image processing with Matlab cengage learning publication

2 Doubhcrty, Digital Image processing for medical application, Cambridge

Suggested List of Experiments :

List of experimental: using C/C++ or matlab or java

Topic-1 : Image Enhancement [Any two Experiments]

1. To enhance image using Histogram Equalization
2. To enhance image using Contrast Stretching
3. To enhance image using spatial filtering
3. To perform Colour Image Enhancement

Topic-2 : Image Segmentation [Any two Experiments]

1. To find edges using LOG and DOG
2. To find Edges using Prewit/ Sobel/ Fri-chen / Robert operators.
3. To find edges using canny Edge Detection.
4. To implement Morphological Operators

Topic-3 : Image Compression [Any Two Experiments]

1. To compress using Huffman coding
2. To compress DCT coefficient of Image
3. To compress Wavelet Coefficient of Image.
4. To compress Binary Image using Run Length Coding

Topic-4 : Application Development [Any Two Experiment]

1. Digital Watermarking
2. Biometric Authentication such as Face / Finger Print / Signature Recognition)
3. Vehicle Number Plate Detection and Recognition,
4. Object Detection using Correlation Principle,
5. Person Tracking using DWT,
6. Handwritten and Printed Character Recognition,
7. Contend Based Image Retrieval,
8. Morphological Toolkit Development
9. Human Expression Detection
10. Image Enhancement using Adaptive Histogram Equalization(AHE), Modified AHE(MAHE), Technique.
11. Image Compression using Vector Quantization
12. Image Compression using JPEG

Term Work:

The term work shall consist of at least six MATLAB Or C/C++ covering the whole of syllabus, duly recorded and graded.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

Oral Examination:

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

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

B. E. Electronics Engineering semester VII	
Subject – Project -I	
Project Hour: 4 Hrs/week	Term work: **25 marks** Oral Exam. : **25 marks** Total marks=**50 marks**
Note: One faculty will not guide more than 3 projects in a semester. For every group allotted to faculty the load is considered as 1 Hour per group per week, be specified in time table of the faculty. Each group will not have more than 4 students.	
Rationale: Project allows the student to work independently to put the knowledge of Electronics engineering theory into practice.	
Detailed description	

Purpose:

- Engineering Project is a technical mandatory course.
- Project is the conclusive effort of independent work in the span of two semesters. The project course challenges the student to explore wide range of topics and opportunities for innovation.
- Responsibility is placed on the student to apply learning from various engineering courses and to seek out and make the best use of the available resources in terms of faculty, staff, library, laboratory, etc.
- This course is an opportunity for students to further develop the managerial skills while working in a team, creative skills by developing novel engineering solutions and communication skills presenting their end application, all necessary to be a successful engineer.
- Introducing the concept of professional literature and Gaining experience in writing a technical document.
- Enhancing employability through the evidence of independent work.

The students of Electronics Engineering are expected to build a project by designing an engineering solution to the any of the following:

- Improvise existing technology
- Real life concerns to improve basic transport/healthcare/pollution/population/security/utility services - water, gas, electricity, drainage, communication etc /infrastructure, housing etc
- Develop mathematical models to facilitate analysis and verifying the same
- Build dedicated or support applications for space/ military/medical commercial/telephone/industrial/ scientific.

To complete the project, students should describe a mathematical model, simulate, design, development, implementation or small research project in an area of specialization.

Note: Topics are given for student reference and students can explore beyond the topics specified under the guidance of project guide

Guidelines:

- Students should work under the guidance of any faculty member from the department.

- A faculty member must officially supervise all projects. Industry/ research Institute's supervisor (Qualified) may, under the direction of a faculty member, also supervise students. A faculty member is always responsible for the grading of every project.

- Group members should not be more than four
- Project is expected to be completed by end of VIII semester
- At the end of VII semester, students should submit synopsis summarizing the work done in VII semester. The objective of this activity is to achieve the following

    - Introduction/need/scope of the project
    - Clarity on the status of project and plan of action for VIII semester
    - Accumulation of the literature survey done (No un-authentic URL): The literature survey should be through standard Text book, References, Other publications of journals like-IEEE, Wiley Interscience, Springer, Elsevier or similar, of repute.
    - Procurement of Software/ Hardware needed for Installation/ Testing of projects in VIII semester
    - Corrective steps to be taken if any

- **Students are expected to adopt systematic approach towards project completion**

    - Each project should follow the scientific method and should apply the problem-solving approaches studied in earlier courses. In general, this includes: Gathering Information: A review of the state of the art should be made using the published literature as well as textbooks and student reports from previous projects if available.
    - Proper Planning: Students must define the project goals and must organize a logical sequence of steps to achieve these goals. This will vary depending on the project, ability to procure materials, availability of equipment, etc.
    - Regular Meetings: Students must meet regularly (weekly-4Hrs in VII Semester and 8 Hrs in VIII Semester) with the project guide.
    - Professional Record Keeping: Proper records are essential and are typically kept in a log book with all details of activity noted. Be sure to

use standard nomenclature and work in the SI system of units. (Log-book will contain in table format: Date/ Activity/ outcome/ comment on outcome/ Resources utilized/ Next meeting date, Target/ Guide's Remark)
Term work
Term work should consist of the above mentioned activities which shall be evaluated and shall carry a weightage of 25 marks.
Oral Examination
The oral examination shall be conducted on the basis on presentation given by the students and shall carry a weightage of 25 marks.

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

SEMESTER: VII

Sr. No	Subjects	No. of periods of 1Hour		Duration of Theory Paper in Hours	Marks			
		Lecture	Practical		Theory Paper	Term Work	Oral	Total
1	VLSI Design	4	2	3	100	25	25	150
2	Filter Design	4	2	3	100	25	25	150
3	Power Electronics and Drives	4	2	3	100	25	25	150
4	Communication Networks	4	2	3	100	25	25	150
5	**Elective-II** 5. Wireless communication 6. Advances in Biomedical Instrumentation 7. Micro computer system design 8. Digital Image Processing Design	4	2	3	100	25	25	150
6	**Project -I**					25	25	50
TOTAL		20	10	15	500	150	150	**800**

SEMESTER: VIII

Sr. No	Subjects	No. of periods of 1Hour		Duration of Theory Paper in Hours	Marks			
		Lecture	Practical		Theory Paper	Term Work	Oral	Total
1	Advance VLSI Design	4	2	3	100	25	25	150
2	Robotics and Automation	4	2	3	100	25	25	150
3	Embedded Systems and Real-Time Programming	4	2	3	100	25	25	150

4	**Elective-III** 5. Advanced Networking Technologies 6. DSP Processors and architectures 7. Neural Networks & Fuzzy Systems 8. Electronics Product Design	4	2	3	100	25	25	150
5	**Project -II**			--		50	100	150
TOTAL		16	08	12	400	150	200	**750**

University of Mumbai			
CLASS: B.E. (Electronics Engineering)		**Semester - VIII**	
SUBJECT: Advanced VLSI Design			
Periods per week	**Lecture**	**04**	
	Practical	**02**	
(each 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 introduce advance design concepts, develop basic understanding of analog VLSI field and relate to issues occurring at chip level**	**-**
Pre-requisite	**VLSI Design, DSD I and II, BEC**	**-**
1. Wire interconnect for circuit simulation	Interconnect parameters (Capacitance, Resistance and Inductance) their effect on circuit performance. Electrical wire models (ideal, lumped, lumped rc, distributed rc and transmission line), switching characteristics, transistor sizing, sizing routing conductors, charge sharing and reliability issues. (Numericals on each subtopic expected)	07
2. Sequential logic circuits design	Clocked systems (Single phase, Two phase and four phase clocking), recommended clocking approaches – clocked CMOS – Dynamic CMOS circuits – solutions for charge sharing - Implementation of general	09

	VLSI sequential system components such as Flip Flops, static as well as dynamic latches and Registers. Pipelining concepts	
3.Aritmetic Circuits in CMOS VLSI	Dynamic adders, Fast adders, Wide adders: Carry look ahead, Block generate and propagate, carry save, carry skip, carry save	06
4. Design of memories & programmable logic	CMOS Memory structures – SRAM and DRAM design –Sense amplifier design - Low power design techniques. ROM Arrays and Logic Arrays. EPROM, EEPROM, Flash cell working . Design of basic 6T SRAM Cell with read and write stability criteria	08
5. Timing issues & System Level Physical Design	Timing classification, Synchronous timing basics, clock skew, propagation delay estimation, clock jitter, combined clock skew and clock jitter estimation, synchronous and asynchronous design timing estimations. Clock generation and distribution Crosstalk, Interconnect Scaling, Floor planning & Routing, I/P & O/P Circuit, Power dissipation and consumption, Low power Design considerations.	09
6. Introduction to Analog and Mixed signal design	Building blocks for CMOS amplifiers, CMOS operational transconductance amplifiers. Frequency compensation schemes. Design of fully differential amplifiers, common mode feedback circuits, switched capacitor circuits. Design of sample and hold and comparator circuits.	09

Text books

1. John P. Uyemura, *Introduction to VLSI Circuits and systems*, John Wiley & sons.
2. Sung-Mo Kang & Yusuf Leblebici, *CMOS Digital Integrated Circuits - Analysis & Design*, Second Ed., MGH
3. Jan M Rabaey, *Digital Integrated Circuits - A Design Perspective*, Prentice Hall
4. D.Razavi, *Design of Analog CMOS circuits,* McGraw Hill

Additional Reading

1. Neil H.E. Weste, Kamran Eshraghian, *Principles of CMOS VLSI Design: A system perspective*, Addison Wesley publication.
2. Fabricius, Eugene D, *Introduction to VISI Design.* TMH
3. P.R. Gray & R.G. Meyer, *Analysis and design of analog integrated circuits*, John Wiley

Proposed Practical list

Suggested list of experiments using CAD tools such as Magic, Microwind, Tanner tools, Xilinx ISE etc.

1. Simulation of resistance and capacitance estimation
2. Simulation of CMOS amplifiers
3. Layout and Simulation of memory structures
4. Layout and Simulation of flip-flop structures
5. Simulation of fast adder circuits

Term work:

The term work should contain at least 6 CAD programs and assignments covering the whole syllabus, duly recorded and graded.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

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

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: B.E. (Electronics Engineering)		**Semester – VIII**	
SUBJECT: Robotics and Automation			
Periods per week (Each 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**

Module	Contents	Hours
Objective	This course familiarizes students with the concepts and techniques in robot manipulator control and in hardware components for automation like Programmable Logic Controllers and also confident enough to evaluate, choose and incorporate robots and PLC in engineering systems.	-
Pre-requisite	1) Matrix Algebra 2) Fundamentals of Image Processing 3) Fundamentals of Controllers	-
1	**Introduction to Robotics** Automation and Robots, Classification, Application, Specification, Notations.	05 hrs
2	**Direct Kinematics** Dot and cross products, Co-ordinate frames, Rotations, Homogeneous Co-ordinates, Link co-ordinates, Arm equation ((Three axis, Four axis, and Five axis robots)	12 hrs
3	**Inverse Kinematics & Workspace Analysis** General properties of solutions, Tool configuration, Inverse Kinematics of Three axis, Four axis and Five axis robots Workspace analysis of Four axis and Five axis robots, Work envelope, Workspace fixtures.	09 hrs
4	**Trajectory Planning and Task Planning** Trajectory planning, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion. Task level programming, Uncertainty, Configuration space, Gross motion planning, Grasp planning, Fine-motion Planning, Simulation of Planar motion, Source and goal scenes, Task planner simulation.	08 hrs

5	**Robot Vision** Image representation, Template matching, Polyhedral objects, Shape analysis, Segmentation, Iterative processing, Perspective transformation, Structured Illumination.	06 hrs
6	**Programmable Logic Controller** Discrete-State Process Control, Relay Controllers background, hardwired control system definition, Ladder Diagram Elements and examples, Relay Sequencers, advantages of Programmable Logic Controller (PLC),Evolutions of PLCs , Block diagram of PLC system – symbols used – relays and PLC Software Functions, logic functions – OR, AND, Comparator, Counters review, PLC Design, PLC Operation, Programming of PLCs – different methods – ladder STL and CSF, ladder programming of simple system like traffic light controller, conveyers, list of various PLCs available.	08 hrs

Text Books:

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India
2. Fu, Gonzales and Lee, Robotics, McGraw Hill
3. J.J, Craig, Introduction to Robotics, Pearson Education
4. Curtis D. Johnson, Process Control Instrumentation Technology, PHI Publication, Eighth Edition

Reference Books:

1. Staughard, Robotics and AI, Prentice Hall of India
2. Grover, Wiess, Nagel, Oderey, “Industrial Robotics”, McGraw Hill
3. Walfram Stdder, Robotics and Mechatronics,
4. Niku, Introduction to Robotics, Pearson Education
5. Klafter, Chmielewski, Negin, Robot Engineering, Prentice Hall of India
6. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications
7. George L Balten Jr., Programmable Controllers , Tata McGraw Hill publications

List of Practicals

These experiments can be performed using

1) Use of Contol-X simulation Control of X-Y Position Table manually and thru Programming.

2) Use of Contol-X simulation Control of Conveyor manually and thru Programming. Programming using sensors and conveyor.

3) Use of Contol-X simulation Program for bottling plant experiment using Conveyer and Pneumatics

4) Use of PLC simulation build a basic circuit using a NORMALLY OPEN INPUT and a NORMAL OUTPUT.

5) Use of P-Simulator design a pneumatic circuit using a double acting cylinder and 5/2 Air Spring Valve to open the main gate of a factory which can be controlled by a security personnel from the security room.

6) Use of H-Simulator design a Hydraulic circuit by using a single acting cylinder to open or close the flush guard door of CNC lathe. The operator can open or close the door at the time of loading or unloading the component.

Term work:

Term work shall consist of minimum six experiments and a written test.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

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

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: B.E. (Electronics Engineering)		**Semester – VIII**	
SUBJECT: Embedded Systems and Real-Time Programming			
Periods per week (Each 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**

	Detailed Syllabus	Hours
1.	Introduction to Embedded systems, Design Metrics, Examples of embedded systems, hardware/software co-design, Embedded micro controller cores (ARM, RISC, CISC, and SOC), embedded memories, sensors and interfacing techniques, Architecture of Embedded Systems.	04
2.	Introduction to MSP 430 RISC Controllers, parallel I/O, external interrupts. Introduction to ARM 7 instruction set, addressing modes, operating modes with ARM core, ARM7 TDMI modes, ADC, Timers, Interrupt structure. Byte ordering (LE, BE), Thumb mode normal mode instructions changes, Pipeline utilization with all register allocations, Floating to fixed point conversion fundamentals. System design with ARM as key processor. DSP features of ARM Core Digital Signal Controllers -DSC differences with conventional micro controllers	12
3	Serial communications: SCI, SPI, Timing generation and measurements. Analog interfacing and data acquisition. Hardware Interrupts: - Various C ISR Declaration syntaxes - Interrupt Vectors, Priorities and Nesting - Tick Timer Interrupt as heart-beat of embedded system 7-Seg LED, Segment-LCD, Alphanumeric LCD, Graphic LCD displays Communications and Networks - RS485 (2 and3 wire)and Modbus Protocol (Intro only) - Ethernet and TCPIP Stack (Features and Usage only) - CAN features and protocol	08

4	Software Programming in Assembly Language (ALP) and in High Level Language 'C', 'C' Program Elements: Header and Source Files and Preprocessor Directives, Program Elements: Macros and Functions, Program Elements: Data Types, Data Structures, Modifiers, Statements, Loops and Pointers, Queues, Stacks, Lists and Ordered Lists, Embedded Programming in C++, 'C' Program Compiler and Cross-Compiler, Source Code Engineering Tools for Embedded C/C++, Optimization of Memory Needs.	08
5.	Real-time concepts, real-time operating systems, Required RTOS services/capabilities (in contrast with traditional OS). Real-world issues: blocking, unpredictability, interrupts, caching, Benefits of using RTOS - Concepts of Tasks/Threads/Process - Multitasking - Task Scheduling - Task management - Inter-task communication and Synchronization: - Device Drivers - How to choose an RTOS	10
6	Fundamentals of Design and Development, Program Modelling tools Testing and Debugging methodologies Applications of Embedded Systems: case studies - Consumer and Home - Industrial and Automation - Medical - Robotics - Access Control Systems (Smart Cards, RFIDs, FingerScan)	06

Text Books:

1. Rajkamal, Embedded Systems - Architecture, Programming and Design, Tata McGraw Hill, Second edition, 2009
2. Shibu K V , Introduction to Embedded Systems , Tata Mc Graw Hill, 2009
3. Sriram Iyer and Pankaj Gupta, Embedded Realtime Systems Programming, Tata McGraw Hill, first edition, 2003

Additional Reading:

1. Embedded Microcomputer Systems -Jonathan W. Valvano – Thomson
2. An Embedded Software Primer – David E. Simon – Pearson Education
3. Embedded real time system, Dr. K.V.K.Prasad, Dreamtech Press.

Suggested Laboratory Experiments

Minimum Six experiments covering topics in the Syllabus

- Interfacing keyboard, LED, LCD Displays
- Programming should be using Suitable IDE and Embedded C
- Serial Communication

Term work:

Term work shall consist of minimum six experiments, Assignments and a written test.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

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

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: B.E. (Electronics Engineering)		**Semester – VIII (Elective)**	
SUBJECT: Advanced Networking Technologies (ELECTIVE)			
Periods per week (Each 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**

Objectives:
Objective of this course is to make students familiar with data communication technologies and how to use them to: Design, Implement, Operate, Manage enterprise networks.

Module	Contents	Hours
1	**Networking Fundamentals:** Overview of Internetworking architecture models: The OSI model, TCP/IP protocol Suite, Addressing, IP versions subneting and supernating. Internetworking Protocols and standards, Standards Organizations, Internet Standards, Connectors, Transceivers and Media converters, Network interface cards and PC cards, Repeaters, Hubs, Bridges, Switches, Routers and Gateways etc. Hardware selection.	08
2	**Optical Networking:** SONET/SDH Standards, devices, DWDM, frame format, DWDM, Performance and design considerations.	06
3	**LAN Technologies:** Wireless LANs technology and IEEE 802.11 Standard. **WAN Technologies :** **Frame** FR concept, FR specifications, FR design and VoFR and Performance and design considerations **ATM** The WAN Protocol: Faces of ATM, ATM Protocol operations. (ATM cell and Transmission) ATM Networking basics, Theory of Operations, B-ISDN reference model, PHY layer, ATM Layer (Protocol model), ATM layer and cell, Traffic Descriptor and parameters, Traffic Congestion control defined, AAL Protocol model, Traffic contract and QoS, User Plane overview, Control Plane AAL, Management Plane, Sub S3 ATM,ATM public services. " "	10
4	**Network Design:** Network layer design, access layer design, access network capacity, network topology and Hardware and completing the access network design.	08
5	**Network Security:** Security threats, safeguards and design for network security **Enterprise Network Security:** DMZ, NAT, SNAT, DNAT, Port Forwarding, Proxy, Transparent Proxy, Packet Filtering and Layer 7 Filtering.	08
6	**Network Management and Control**	08

	Documentation, OAM & P, RMON, Designing a network management solution. Monitoring and control of network activity and network project management.	

Text Books:

1. Data Network Design by Darren Spohn, 3e McGraw Hill publications
2. Data Communication and Network Security by Carr and Snyder, McGraw Hill Publications.
3. Communication Networks by Leon-Garcia and Indra Widjaja, 2e, Tata McGraw-Hill Publications.
4. Information Security by Mark Stamp and Deven Shah by Wiley Publications.
5. Behrouz A Forouzan, Data communications and Networking 4th Edition, McGraw-Hill Publication.
6. William Stallings, Data Computer Communications, Pearson Education

Reference Books:

1. Eldad Perahita ,Next Generation wireless LANS, Cambridge Publication
2. Computer Networking by J. F. Kurose and K. W. Ross, Pearson Education
3. Local Area Networks by Gerd Keiser, McGraw-Hill Publication.

Proposed Practical list:

1. Network Monitoring and Traffic Analysis: NMAP and NTOP
2. Remote Login Service: SSH
3. Network Traffic Modeling using Etherape
4. Firewall Design using IPTables

Term work:

Term work shall consist of minimum six experiments, tutorials and a written test.

The distribution of marks for term work shall be as follows,
Laboratory work (Experiments and Journal) : 15 marks.
Test (at least one) : 10 marks.
The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

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

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: B.E. (Electronics Engineering)		**Semester – VIII (Elective)**	
SUBJECT: DSP PROCESSORS AND ARCHITECTURES			
Periods per week (each 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 DSP algorithms are better implemented on DSP processors having specially tailored architectures. It is therefore essential for a DSP systems designer to understand these processors and apply them in system design.
Pre-requisite	Fundamentals of Discrete time signal processing

Module	Contents	Hours
1	**FUNDAMENTALS OF PROGRAMMABLE DSPs** Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory , Multi-ported memory , VLIW architecture, Pipelining , Special Addressing modes in P-DSPs , On chip Peripherals, Computational accuracy in DSP processor	6
2	**ADSP PROCESSORS** Architecture of ADSP-21XX and ADSP-210XX series of DSP processors	6
3	**TMS320C5X PROCESSOR** Architecture, Assembly language syntax, Addressing modes Assembly language Instructions - Pipeline structure, Operation Block Diagram of DSP starter kit Application Programs for processing real time signals.	8
4	**PROGRAMMABLE DIGITAL SIGNAL PROCESSORS:** Data Addressing modes of TMS320C54XX DSPs,Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program	12

	Control,, On-Chip peripherals, Interrupts ofTMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors	
5	**ADVANCED PROCESSORS** Code Composer studio -Architecture of TMS320C6X - architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.	8
6	**IMPLEMENTATION OF BASIC DSP ALGORITHMS:** An FFT Algorithm for DFT Computation, ,Computation of signal spectrum, FIR Filters, IIR Filters, interpolation Filters, Decimation filters, Adaptive Filters	8

Text- Books:

- B. Venkata Ramani and M. Bhaskar, Digital Signal Processors, Architecture, Programming and TMH, 2004.
- Avtar Singh, S.Srinivasan DSP Implementation using DSP microprocessor with Examples from TMS32C54XX -Thamson 2004
- E.C.Ifeachor and B.W Jervis,Digital Signal Processing A Practical approach, Pearson Publication
- Digital signal processing, Salivahanan. Ganapriya, TMH ,second Edition

Reference Reading:

- DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.
- Digital signal processing-Jonathen Stein John Wiley 2005
- S.K. Mitra, Digital Signal Processing, Tata McGraw-Hill Publication, 2001

.**Suggested list of Experiments /simulations**

1. Numbers representation. Fixed Point Representation (Qx, IQ Format).
2. Effect of sampling rate on waveform generation using DSP processor(Using CCS)
3. DFT computation using DSP processor
4. FIR filter design using MATLAB and find finite word length effect
5. .FIR filter design using DSP processor
6. IIR filter design using MATLAB and find finite word length effect
7. IIR filter design using DSP processor
8. Analysis of speech signal
9. Application Development using CCS. Examples Signals Acquisition, DTMF tone detection techniques and the Goertzel algorithm, A GMSK Modulator Implementation

Term Work: The term work shall consist of at least six assignments and experiments on DSP processors /simulations covering the whole of syllabus, duly recorded and graded.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

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

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 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: B.E. (Electronics Engineering)		Semester – VIII(Elective)	
SUBJECT: NEURAL NETWORKS & FUZZY SYSTEMS			
Periods per week (each of 60 min.)	**Lecture**	**3**	
	Practical	**2**	
	Tutorial	**-**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**3**	**100**
	Practical examination		
	Oral Examination	**-**	**25**
	Term Work	**-**	**25**
	Total		**150**

Objective	This course covers basic concepts of artificial neural networks, fuzzy logic systems and their applications. Its focus will be on the introduction of basic theory, algorithm formulation and ways to apply these techniques to solve real world problems.
Pre-requisite	Knowledge of basic probability and statistics with the . Programming skills in one of the following would be desirable: Matlab,, C, C++ ,Java.

Module	Contents	Hours
1	**Introduction:** Biological neurons, McCulloch and Pitts models *of* neuron, Types of activation function, Network architectures, Knowledge representation Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules	08
2	**Single Layer Perception:** Perception convergence theorem, Method steepest descent - least mean square algorithms	08
3	**Multilayer Perception:** Derivation of the back-propagation algorithm, Learning Factors.	06
4	**Radial Basis and Recurrent Neural Networks:** RBF network structure theorem and the reparability of patterns, RBF learning strategies, K-means and LMS algorithms, comparison of RBF and MLP networks, Hopfield networks: energy function, spurious states, error performance	08
5	**Neuro-dynamics :** Attractors, Neurodynamical model, Adaptive Resonance theory , Towards the Self Organizing Feature Map. Brain-state-in- a-box model,	08
6	**Fuzzy logic:** Fuzzy sets, Properties, Operations on fuzzy sets, Fuzzy relation Operations on fuzzy relations, The extension principle, Fuzzy mean Membership functions, Fuzzification and defuzzification methods, Fuzzy controllers	10

Text- Books:

- Simon Haykin, *"Neural Network* a - *Comprehensive Foundation",* Pearson Education
- Dr.S.N.Sivanandam,Mrs S.N. Deepa Introduction to Soft computing tool Wiley Publication
- Satish Kumar Neural Networks:A classroom Approach Tata McGraw-Hill
- Zurada J.M., *"Introduction to Artificial Neural Systems,* Jaico publishers
- Thimothv J. Ross, "Fuzz *V Logic with Engineering Applications",* McGraw
- Ahmad Ibrahim, *"Introduction to Applied Fuzzy Electronics',* PHI
- Rajsekaran S, Vijaylakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms, PHI

Reference books

- Hagan, Demuth, Beale, 'Neural Network Design', Thomson Learning
- Christopher M Bishop Neural Networks For Pattern Recognition ,Oxford Publication
- William W Hsieh Machine Learning Methods in the Environmental Sciences Neural Network and Kernels Cambridge Publication
- Dr.S.N.Sivanandam,Dr.S.Sumathi Introduction to Neural Network Using Matlab Tata McGraw-Hill

List of experimental: using C/C++ or Matlab or java

- Single layer perceptron neural network
- Multi layer perceptron neural network
- Back propagation neural network
- Radial basis and recurrent Neural network
- Fuzzification and de fuzzification

Term Work:

The term work shall consist of at least six assignments and experiments using MATLAB Or C/C++ or Java covering the whole of syllabus, duly recorded and graded.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

Oral Examination:

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

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: B.E. (Electronics)		**Semester – VIII (Elective)**	
SUBJECT: ELECTRONIC PRODUCT DESIGN			
Periods per week (Each 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**

Module	Contents	Hours
Objective	**To cover product design & development stages and total coverage of product assessment by introducing the basics of reliability and quality of electronic product and then discusses the various modes and causes of failure.**	-
1	**Product Design and development** Introduction, An overview of product development & product assessment, Pilot production batch, Concept of availability, Screening test , Environmental effects on reliability, Redundancy, Failsafe system, Ergonomic & aesthetic design considerations, Packaging & storage Estimating power supply requirement (Power supply sizing), Power supply protection devices Noise consideration of a typical system, Noise in electronic circuit, Measurement of noise Grounding, Shielding and Guarding	12hrs

	Enclosure sizing & supply requirements & materials for enclosure and tests carried out on enclosure Thermal management and its types	
2	**PCB designing** Layout, PCB sizes, Layout – General rules & parameters. Recommendations for decoupling & bypassing. Design rules for digital circuit PCB & analog circuit PCBs Noise generation, Supply & ground conductors Multilayer boards Component assembly & testing of assembled PCB, Bare board testing. Component assembly techniques Automation & computers in PCB design, Computer aided design , Design automation Soldering techniques, Solderability testing Study of packages for discrete devices & ICs, IC reliability issues. Parasitic elements Calculations of parasitic elements in high speed PCB. High speed PCB design and points to be considered for designing the high speed PCBs Mounting in presence of vibration. SMD assemblies Board layout check list. Tests for multilayer PCB Cable	12hrs
3	**Hardware design and testing methods** Logic analyzer, its architecture & operation and Use of logic analyzer Spectrum analyzer Network analyzer, Oscilloscope , DSO trigger modes Examples using MSO Signal integrity issues Use & limitations of different types of analysis Monte Carlo analysis	6hrs

4	**Software design and testing methods** Introduction Phases of software design & Goals of software design Methods of program flow representation Structured program construct Testing & debugging of program Software design Finite state machine Decision to use assembly & / or high level language for software development Assembler Compilers, Compilers design Simulators, CPU Simulators Emulators	6hrs
5	**Product testing** Environmental testing for product. Environmental test chambers & rooms. Tests carried out on the enclosures Electromagnetic compatibility (EMC) with respect to compliance. Electromagnetic compatibility (EMC) testing . Conducted emission test (time domain methods). Radiated emission test Basics on standard used. Instrument specifications	6hrs
6	**Documentation** PCB documentation- Specifying laminate grade, drilling details, PCB finish- Tin, solder, gold, silver plating, hot air leveling, and bare board testing. Understanding advantages and limitations of each Product documentation- bill of materials, Production test specification- a case study for real circuit, Interconnection diagram- A case	6hrs

	study., Front and rear panel diagrams for selected product Manuals- Instruction or operating manual, Service and Maintenance manual, Fault finding tree Software documentation practices- For C programmes, Assembly programmes with particular focus on development of programme by several engineers simultaneously.	

Recommended Books:

Text

1. Electronic Product Design, R.G.Kaduskar, V.B.Baru, Wiley India

Reference

1. Printed Circuit Board design and technology – Walter C Bosshart Tata McGraw –Hill-CEDT
2. Handbook of Printed Circuit manufacturing – Raymond H. Clark (Van Nostrand Reinhold Company, New York)
3. Electronic testing and fault diagnosis –G.C. Loveday (Ah wheeler Publication, India)
4. Electronics Engineers reference book 5th Edition – Edited by F.F. Mazda Butterworths Publication Co., UK)
5. Principles of Reliable Soldering Techniques, Sengupta R., New Age International

Term work:

Term work shall consist of minimum four experiments & 3 tutorials and a written test.

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

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

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

Oral Examination:

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

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Questions will be analytical and design oriented.
4. Question number 1 will be compulsory and cover all modules.

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

B. E. Electronics Engineering **Semester VIII**	
Subject – Project -II	
Project Hour: 8 Hrs/week	Term work: **50 marks** Oral / Practical/ Presentation / Demonstration examination: **100 marks** Total marks= **150 marks**
Note: One faculty will not guide more than 3 projects in a semester. For every group allotted to faculty the load is considered as 2 Hour per group per week, be specified in the time table of faculty.	
Rationale: Project allows the student to work independently to put the knowledge of **Electronics engineering** theory into practice.	
Detailed description	

In continuation to the efforts taken towards building the project in VII semester, during VIII semester, students are expected to complete their project idea and meet the set goals and compile the project report.

FINAL PROJECT REPORT

Your guide will give you specific instructions as to the expected content of your final report. The report should cover the progress that has been made, including results obtained, graphical data, design drawings, and a statement of conclusions and recommendations (if applicable). Details of theory, experimental data, computer programs, purchased materials, sources and suppliers etc., must be included. Your report must be sufficiently complete that a student continuing your project would benefit from your report and would not be required to duplicate any of your work.

PROJECT MARKING SCHEME

A project used to assign marks in three general categories, as explained below. Achievement in each of these areas is critical to a successful project.

Project Goals & Achievements (20%): Guide will evaluate both the difficulty of the goals and whether the goals were achieved. Although projects will differ, it is always extremely important to set goals at the start of a project and work toward these goals. The project goals should be set in collaboration with the guide and an effort should be made to establish a realistic scope for the project. In some cases, it may become apparent as the project progresses that the original goals need to be adjusted and a modified set of goals must be set.

Final Report Quality & Content (40%): This is an evaluation of the quality of the final report based on the report format, the clarity of communication and the analytical content.

Student Organization, Creativity & Effort (40%): This portion of the evaluation reflects the student's performance, with emphasis on effort, organization,

creativity and initiative.

Project Report Outline

The hard-bound report will contain following details:

- Title
- Certificate
- Acknowledgement (if any)
- Table of Contents
- List of Figures
- Abstract
- Introduction
- Literature Survey
- Mathematical Modeling/ Analysis and Design
- Implementation
- Result and Discussion
- Conclusion and Future Scope
- Reference
- Appendix (optional)

Term work

Term work shall consist of the above mentioned activities which shall be evaluated and shall carry a weightage of 50 marks

Oral Examination

The oral examination shall be conducted on the basis on presentation/ practical / demonstration given by the students and shall carry a weightage of 100 marks

B.E. Electronics Engineering	
VII-Seventh Semester (R2001) -Old	Equivalent VII-Seventh Semester (R2007)-Revised
1. Basics of VLSI	VLSI Design
2. Instrumentation Systems	Electronic Instrumentation Systems (TE, VI sem R-2007)
3. Digital Communication	Digital Communication and Coding Techniques (TE, V sem R-2007)
4. Filter Theory and Applications	Filter Design
5. Elective – I	
Wireless Communication	Wireless communication
Image Processing	Digital Image Processing Design
Microprocessor System Design	Micro computer system design
DSP Architecture	DSP Processors and architectures (VIII – R2007)
Process Control Instrumentation	No Equivalent*

*** Student needs to appear in the same subject of R-2001**

B.E. Electronics Engineering	
VIII-Eighth Semester (R2001) - Old	Equivalent VIII-Eighth Semester (R2007)-Revised
1. Power Electronics	Power Electronics and Drives(VII –R2007)
2. Data Communication & Networking	Communication Networks
3. Mechatronics	No Equivalent*
4. Elective – II	
VLSI Design	Advance VLSI Design
Robotics	Robotics and Automation
Telecom Network Management	No Equivalent*
Embedded System	Embedded Systems and Real-Time Programming
Advance DSP	No Equivalent*
Bio-medical Instrumentation	Advances in Biomedical Instrumentation

*** Student needs to appear in the same subject of R-2001**