Shivaji University, Kolhapur

(Implemented from June, 2005)

Revised Syllabus w.e.f. July, 2005

B.E.(Electronics Engineering) Part - I

Sr. No.	Subject	Teaching Scheme			Examination Scheme			
		L	T	P	P	TW	POE	OE
01	Embedded Systems	4	--	2	100	25	50	--
02	Digital Communication	3	--	2	100	25	--	--
03	Digital Signal Processing	4	--	2	100	25	--	--
04	Power Electronics	4	--	2	100	25	50	--
05	Elective- I*	3	--	--	100	25	--	--
06	Project-I	--	--	4	---	25	--	50
	Total:-	18	--	12	500	150	100	50

B.E. (Electronics Engineering) Part - II

Sr. No.	Subject	Teaching Scheme			Examination Scheme			
		L	T	P	P	TW	POE	OE
01	Audio & Video Engg.	4	--	2	100	25	50	--
02	Microwave Engineering	4	--	2	100	25	--	--
03	Computer Network	4	--	2	100	25	--	50
04	Elective-II*	4	--	--	100	25	--	--
05	Project-II	--	--	8	--	50	--	150
	Total:-	16	--	14	400	150	50	200

List of Electives –

Elective-I	Elective-II
1. Advanced Control Engineering	1. Neural Networks
2. Bio-medical Instrumentation	2. Image Processing
3. Remote Sensing & GIS	3. Mechatronics
4. Real Time Systems	4. Information Technology
5. Fuzzy Logic	5. Broadband Communication
	6. System On Chip

*** Note -**

1) Term work of the elective subjects should be carried out on "virtual labs" using lab view software and implementation of the same can be checked on "Elvis" hardware interface.

2) The tutorials of Elective-I and Elective-II be conducted during regular lecture hours only.

A)Term work Assessment Scheme :-

The term-work of each subject shall be assessed on the basis of tutorials and the class-tests as under.

(For Tutorials)

a) Tutorial (minimum 8) - 15 Marks.

b) Class tests (minimum 2) - 10 Marks.

(For Practical)

a) Practical	-	15 Marks.
b) Class tests (minimum 2)	-	10 Marks.

B) Nature of Question paper for B.E.(Electronics) Part – I & II
(Applicable to all subjects)

1. There shall be a total of 6 questions in each paper all being compulsory with internal options.
2. The first question in each section shall carry 20 marks covering all topics in that section and the remaining two questions will carry 15 marks in each section.
3. Duration of each paper shall be 3 hours carrying maximum 100 marks.
4. The question paper shall consist of minimum 40% numerical problems.

SHIVAJI UNIVERSITY, KOLHAPUR

(Implemented from June, 2005)
B.E.(Electronics) –Part - I (Revised)

1 Embedded Systems

Lecture - 4 hrs / week
Practical - 2 hrs / week

Paper - 100 marks
Term work - 25 marks
POE - 50 marks

Section I

1. Introduction to Micro-control1ers (1 hr.)

a. Difference between micro-processors and micro-controllers

2. 8 bit Micro-control1er: MCS51 family (8 hrs.)

a. 8051 Architecture
b. Memory organization and Special Function Registers (SFRs)
c. Integrated peripherals such as Timers/Counters, Serial port, parallel 1/0 ports, Interrupt Structure.
d. Instruction set and Assembly Language Programming.
e. Interfacing by port pins and Interfacing by memory mapping.
f. Study of examples of MCS51 family micro-controllers
   i) AT89C52 (special feature = 8KB flash EPROM)
   ii) 89C668 (special features = 64KB flash ISP EPROM, 8KB SRAM, PCA, 12C interface)
   iii) P89C51RD2 (special features = 64KB flash ISP EPROM, 12C interface, SPI interface)

3. Microcontrol1er RISC family (11hrs.)

a. Difference between RISC and CISC Architectures.
b. ARM Controller
   i) Architecture.
   ii) Memory organization
   iii) Pipeline and cache concepts
   iv) ARM (32 bit) and THUMB (16 bit) operating modes.
   v) Introduction to "Instruction set and Assembly Language Programming
   vi) ARM instruction set and THUMB instruction set
   vii) Switching between ARM and THUMB instructions
c. PIC Controller
   i) Architecture.
   ii) Memory organization
   iii) Interrupts
   iv) Inbuilt controller features (ADC, PWM, timer, etc)
   v) Assembly instruction set and Introduction to C Programming.
d. Study of examples of ARM and RISC family Micro-controllers
   i. Philips: LPC2104/05/06
   ii. Atmel: AT91M42800A
   iii. Microchip: PIC 16F877

Section II

4. Development tools for Embedded Systems **(5**hrs)

a. Software development tools
   i) Assembler, Linker
   ii) Simulator
   iii)Compiler

b. Hardware development tools
   i) Programmer (EPROM programmer, uc programmer, Universal programmer)
   ii) Logic Analyser
   iii) General purpose Evaluation Boards / Single Board Corn

c. Hardware + Software combination tools
   i. In Circuit Emulator
   ii. Debugger

5. Embedded C Programming (7 hrs)

a. C Programming for Micro controller
b. Optimizing techniques
c. Interrupt sub-routines in C
d. Design patterns for embedded C programming
e. C programming for MCS51
f. C programming for ARM

6. Real Time Operating System (RTOS)

a. Introduction to RTOS concept (5 hrs)
b. Introduction to "Embedded software development using RTOS

7. Communication / Networking standards for embedded systems (8 hrs)

a. UART (serial port)
b. Buses like 12C, SPI
c. Ethernet network
d. Universal Serial Bus (USB) *I*
e. Controller Area Network (CAN)

List of experiments:

First 2 experiments (assembly language programs) are mandatory. Any one experiment from 3 or 4 can be done. Thus total 3 experiments should be done on Assembly language programming for 8051. Any four of experiments 5-10 can be done. Thus total 5 experiments should be doe on C programming for 8051. Experiment 11 & 12 are mandatory – these will introduce the students to Assembly Language and C programming for ARM microcontroller.

1. Simple assembly language program: Realization of Boolean expression

using port.

2. Simple assembly language program: Running LEDs

3. Using Timer Couter for frequency measurement, by counting the number of pulses in fixed amount of time (e.g. 1 second)(Assembly Language Programm).

4. Using Timer/Counter for frequency measurement, by measuring the time period between two consecutive pulses (Assembly Language Program).

5. Write serial communication program in C. This program should:

b. Send a ASCII message to serial port (verify receipt of this message on a computer)

c. Then onwards, echo any character received (send characters from computer and verify receipt of echo).

6. Design and/or study of minimum system based on 8051 family micro-controller. This should include at leaset one port pin based interfacing example (e.g. LCD or 7 segment LED display). Program to display a message on LCD or LED should be written in C.

7. Design and/or study of large system based on 8051 family micro-controller. This should include at least one example of "memory mapped interfacing" (e.g. ADC LCD), Program to read ADC and display reading on LCD should be written in C. Interrupt should be used to incicate "ADC conversion complete", Thus this C program should include an interrupt service sub-routine.

8. In the context of experiment #7 above, study the behavior of following signals on Logic Analyzer.

a. ALE
b. /WR
c. /RD
d. AD0-AD7
e. A8-A15
f. /CS signal(s) of ADC
g. EN signal of LCD

9. Using on-chip ADC and DAC of an 8051 family micro-controller. This program should be written in C.

10. Implementing a bus interface such as 12C or SPI. Write C program to implement 12C or SPI bus, demonstrate working of the program with one example. (e.g. reading/writing a 12C or SPI compatible device such as EEPROM).

11. Study of minimum system based on ARM family micro-controller (e.g. LPC2104) and writing an Assembly Language Program for running LEDs.

12. Study of large system based on ARM family micro-controller, and writing C program to display a message on LCD.

Reference Books:-

1. 8051 Microcontroller By Mazidi M.A.

2. 8051 Microcontroller & Embedded systems By Madizi M.A.

3. 8051 Microcontroller Data Book.

4. ARM processor data book.

5. Atmel Microcontroller data book (AT89).

6. Philips Microcontroller Data Book.

7. 8051 Microcontroller by Kenneth Ayala.

8. ARM Architecture Reference Manual Edited By David Seal.

B.E.(Electronics) –Part- I (Revised)
2. DIGITAL COMMUNICATION

Lecture - 3 hrs / week	Paper - 100 marks
Practical - 2 hrs / week	Term work - 25 marks

Section – I

1. **Information Theory:-** (8 hrs)
   Introduction to information theory, average and mutual information. Entropy, Joint entropy and conditional entropy, Rate of information, redundancy, channel capacity, Shannon's Theorem, Shannon – Harley theory, bandwidth, S/N trade off, entropy coding.
2. **Noise :** (4 hrs)
   Noise equivalent Bandwidth, thermal white etc. Random signals and processes related to noise, Interfernece and noise comparison with linear modulation & FM generation and detection.

3. **Source Coding :-** (6 hrs)
   Uniform, non-uniform quantization, PCM, DPCM, ADPCM, DM, ADM, CVSD, performance of the above coding schemes based on S/N.

Section – II

4. **Carrier Modulations and Detection:** (5 hrs)
   ASK, FSK, PSK, BPSK, DPSK, DEPSK, QPSK, QAM, MSK, detection Schemes.

5. **Channel Encoding:** 6 hrs)
   Block codes, cyclic codes, systematic and non systematic, Convolution codes, Turbo coding, Criteria for code selection, Practical consideration in the application of the code.

6. **Optimum Detection:-** (4 hrs.)
   Matched filter, Decision theory, Bay's Criterion, Minimum error criterion, Minmax criterion, Ncyman-Pearson criterion, receiver operating characteristics.

7. **Synchronization:-** (4 hrs)
   Symbol synchronization circuits, frame synchronization, carrier recovery circuits, ISI and its minimization, Eye Diagram.

List of Experiments (all compulsory) -

1. Study of DPCM, ADPCM.
2. Study of DM, ADM, CVSD.
3. Measurement of Quantization noise in PCM.
4. Design and realization of Hamming codes using digital ICS.
5. Study of ASK, FSK.
6. Study of BPSK, DPSK.
7. Study of FSK modem for 8 channels PCM.
8. Study of TDM and FDM.

References:-

1. Principles of communication system by Taub & Schling.
2. Digital Communication System Design – M.S. Roden.
3. Digital Communication by Simon Hykin.
4. Communication System Analog & Digital by Singh & Sapre.
5. Digital Communication by Proakis.
6. Digital & Analog Communication systems – K. Sam Shanmugan Wiley International Publication – PHI.

B.E.(Electronics) - Part- I (Revised)

3. DIGITAL SIGNAL PROCESSING

Lecture - 4 hrs / week
Practical - 2 hrs / week

Paper - 100 marks
Term work - 25 marks

Section – I

1 **Digital Signals and Systems** **(6 hrs.)**
DSP system concept, properties of DSP system sampling theorem, DT signals, analysis of DTLTI system. Convolution and Co-relation of DT signals.

2. **Z – Transforms** **(6 hrs.)**
Z – Transforms and it's properties, Inverse Z – Transformers, Digital T.F. – stability considerations and frequency response, Bilinear Z – Transform.

3. **The Discrete Fourier Transform and FET** **(12 hrs.)**
DFT, Relation between DFT and Z –Transform. Properties of DFT, Circular convolution, windows and DFT.
FFT algorithms (DIT FFT & DIF FFT) implementation aspects, fast convolution signal segmentation (overlap save & overlap-add algorithm) correlation – circular correlation, DFT property of circular correlation.

Section – II

4. **Realization of Digital Linear System** **(2 hrs.)**
Filter categories, IIR direct form structures cascode, parallel realization, FIR filter realization.

5. **FIR Filter Design** **(6 hrs.)**
Characteristics of FIR filter, properties of FIR filter, digital N/W for FIR filter windowing method, filter design using Kaiser window.

6. **IIR Filter Design.** **(7 hrs.)**
Impulse invariant Tech. Bilinear transformation frequency band transformation, analog filter approximation (Butterworth, Chebysher, Elliptic) quantization and rounding problems, Effect of finite word length on stability and frequency response.

7. **Introduction to Wavelet Transform** **(5 hrs.)**
Continuous time wavelet inverse continuous wavelet, discrete time wavelet, inverse discrete time wavelet, application of wavelet to denoising.

List of Experiments.

1. Minimum 8 experiments on above topic.
2. Using math lab/C

Reference Books:

1. Digital Signal Processing – Principles, Algorithms and Application
   By John G Prokis.
2. Discrete Time Signal Processing
   By A.V.Oppenheins and R.W. Schalfer (PHI)
3. Digital Signal Processing
   By S. Salivahanam, A Vallavaraj, C. Guanapriya (TMH)
4. Digital Signal Processing 3/ed.
   By A.C. Bhagat (Mahalaxmi publication)
5. Introduction to DSP
   By Johnny R. Johnson
6. Wavelet Transforms – Introduction to theory and applications
   By Raghuveer M. Rao and Ajit S. Boperdikar – Pearson Education.
7. Wonderful Worlds of Wavelets
   By Margret Hubbard
8. Scientist and Engg. Guide on Digital Signal Processing.
   By Smith

B.E.(Electronics) - Part- I (Revised)

4. POWER ELECTRONICS

Lecture - 4 hrs / week	Paper - 100 marks
Practical - 2 hrs / week	Term work - 25 marks
	POE - 50 marks

Section I

1. **Single Phase Controlled Rectifier**:- (3 hrs.)
   Overview of 1 phase rectifier, 1 phase fullwave controlled rectifier with R and Battery load, RL and battery load.
2. **Three Phase Controlled Rectifier.** (10 hrs)
   Three phase half wave controlled rectifier with resistive load, Three phase half controlled bridge rectifier with R & RL load, Three phase full controlled bridge rectifier with R and RL load, Calculation of performance parameters (for continuous current operation using fourier analysis).
3. **Triggering Circuit for Phase Controlled Rectifiers** (4 hrs)
   Pulse forming circuits, inverse cosine method, microprocessor/microcontroller based firing circuit for 1 phase, 3 phase controlled rectifiers.
4. **Choppers** (7 hrs)
   Types of choppers, single quadrant, two quadrant, four quadrant, control techniques of chopper, series turn off chopper, parallel capacitor turn off chooper, single SCR Chopper, Jones and Margan chopper, step up chopper, multiphase chopper, chopper circuit design.

SECTION-II

5. **Inverters.** (8 hrs.)
   Transistorised inverters, 1 phase half bridge, full bridge, 3 phase bridge inverters – 120 & 180 degree conduction modes, classification of inverters. SCR inverters-series inverter, parallel inverter, Mc-Murray 1 phase half bridge and full bridge inverter, design of commutating components, Mc-Murray Bedford inverter, control of inverter output voltage, harmonic reduction techniques.
6. **Cycloconverters.** (4 hrs.)
   1 phase to 1 phase, 3 phase to 1 phase, 3 phase to 3 phase Cycloconverters, harmonic reduction techniques, circulatory & noncirculatory current mode.
7. **DC motor control.** (6 hrs.)
   Basic characteriscits of DCM, operating modes, single phase and 3 phase fullwave converter drives, 1 phase and 3 phase dual converter drive, 4 quadrant operation of DCM, chopper drives.
8. **AC motor control.** (6 hrs.)
   Performance characteristics of Induction motor, starter voltage control, rotor control, frequency control v/f control, combined controls. (mathematical treatment)

Reference Books:-

1. Power Electronics – M.H. Rashid.
2. Power Electronics – Vedam Subramanyam.
3. Power Electronics – P.C. Sen.
4. Thyristrised Power Converters by Dubey, Sinha, Poralda.

B.E.(Electronics) - Part- I (Revised)
ELECTIVE – I
i) ADVANCED CONTROL ENGINEERING

Lecture - 3 hrs / week

Paper - 100 marks
Term work - 25 marks

Section – I

1. **Control system analysis and design by conventional methods: overview** (05 hrs.)
   Root locus analysis of control system, system with transport lag, Root confour plots, Bode diagram, Polar plots, Nyguist stability criterion, Stability analysis, experimental determination of transfer functions.

2. **Signal Processing in Digital Control** (05 hrs.)
   Why Use Digital Control, Configuration of the Basic Digital Control Scheme, Principles of Signal Conversion, Basic Discrete – Time signals, Time – Domain models for discrete – time systems, Transfer function models, Stability on the Z-plane and the Jury stability criterion, Sampling as Impulse Modulation, Sampled Spectra and Aliasing, Filtering Practical Aspects of the choice of sampling rate, Principle of discretization, The Routh stability criterion on the r- plane.

3. **Digital Control Devices and Systems and Algorithms.** (10 hrs.)
   Introduction, z-Domain description of sampled continuous – time plants, z-Domain description of systems with Dead – Time, Implementation of Digital Controllers, Digital temperature control system, Digital position control system, Stepping motors and their control.
   z- plane specifications of control system design, Digital compensator Design using frequency response plots, Digital compensator Design using root Locus plots, z- plane Synthesis.

Section – II

4. **Control System Analysis using state variable methods.** (08 hrs.)
   Introduction, Vectors and Matrices, State variable representation, Conversion of state variable models, to Transfer functions, Conversion of Transfer functions to canonical state Variable models, Eigenvalues and Eigenvectors, Concepts of controllability and observability, Equivalence between transfer function and state variable representations, multivariable systems.

5. **State variable analysis of Digital control systems.** (06 hrs.)
   Introduction, State descriptions of Digital Processors, State Description of sampled continuous-time plants, State Description of systems with Dead- Time, Solution of State difference equations, Controllability and observability, Multivariable systems.

6. **Pole-placement Design and State observers** (06 hrs.)
   Introduction, Stability improvement by state feedback, Necessary and sufficient conditions of arbitrary pole-placement, State regulator design, Design of State Observers, Compensator Design by the separation principle, Servo design: Introduction of the reference input by feed forward

control, State Feedback with Integral Control, Digital Control systems with state feedback, Deadbeat control by state feedback and Dead beat observers.

7. Industrial Robotics (02 hrs.)

Role of robotics in automatic work. Robotics anatomy. Design of control systems for industrial robots.

Reference Book:

1. Modern Control Engg. – By Katsuhiko Ogata – PHI Publication.
2. Introduction to Electronics Control Engg. – By Frohr/OrHenburger Wiley Estern
3. Digital Control Engg. By M. Gopal
4. Hand Book of Industrial Robotics (1985) Edited by S.Y.Nof (Wiley)
5. Digital Control system – By Kuo B.C. (2^{nd} Edn. Wiley Eastern.)
6. Discrete Time Control Systems – By Ogata K. (PHI)
7. Digital Control And State Variable Methods – By M. Gopal (Tata McGraw Hill)

B.E.(Electronics) - Part- I (Revised)
ELECTIVE – I
ii) BIOMEDICAL INSTRUMENTATION

Lecture - 3 hrs / week

Paper - 100 marks
Term work - 25 marks

Section – I

1. Introduction to Biomedical Instrumentation : (06 hrs.)
Biometrics, basic design specifications of biomedical instrumentation system in terms of range, linearity, hystersis, frequency response, accuracy, signal to noise ratio, stability insolation simplicity, physiological system of body: biochemical system, cardiovascular system, respiratory system, nervous system. Source of bioelectric potential resting and action potential, propagation of action potential.

2. Electrodes and Transducers : (06 hrs.)
Microelectrodes, skin surface electrode, needle electrode, electrodes and lead for EG, ECG, EMG. Transducer for biomedical applications, factors governing the selection of transducer, pressure, temperature, flow, biomedical ultrasonic transducer.

3. Bio Signal Amplifiers and Signal Processing : (05 hrs.)
Signal conditioner, amplifier used in biomedical instrumentation, requirement of amplifier, input isolation, DC amplifier, power amplifier, differential amplifier carrier amplifier, instrumentation amplifier. Introduction to biomedical digital signal processing and biomedical telemetry.

4. Electrophysiology and Cell Structure : (04 hrs.)
Bioelectric signal generated by muscles of heart, neuronal activity of brain, muscle activity. Block study of ECG, EEG and EMG. Electrodes and leads for ECG, EEG & EMG

Section – II

5. **Cardiovascular Instrumentation :** (05 hrs.)
   Measurement of blood pressure, blood flow, and heart sound, cardiography: Phonocardiography, vector cardiography, Echocardiography pacemaker, defibrillators, Ventilator.

6. **Imaging Systems :** (04 hrs.)
   Ultrasonic imaging system, basic pulse – echo system, block study of a mode scan equipment, multidement transducer system, X-ray machine, CT scanner.

7. **Study of Clinical Laboratory Equipments :** (03 hrs.)
   Spectrophotometer, auto analyzers, blood cell counter, and electro surgical unit – Diathermay.

8. **Patient Care Monitoring :** (04 hrs.)
   Elements of intensive care unit, diagnosis, calibration and reparability of patient monitoring equipment, instrumentation for monitoring patient, pacemakers, detibrillators and computer patient monitoring system.

9. **Electrical Safety of Medical Equipments.** (03 hrs.)
   Physiological effects of electric current, shock hazards from electric equipment and methods of accident prevention.

Reference Books:

1. Biomedical Instrumentation & Measurement – By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer (PHI)
2. Handbook of Biomedical Instrumentation – By R.S.Khandpur (TMH)
3. Bioelectronic Measurement – By Dean A Dmane, David Michaels (Prentice Hall)
4. Medicine and Clinical Engineering – By Jacobson and Webster, (PHI)
5. Introduction to Biomedical Equipment Design – Carr and Brown, John Wiley
6. Biomedical Digital Signal Processing – By Tompkins.

B.E.(Electronics) - Part- I (Revised)
ELECTIVE – I
iii) REMOTE SENSING AND GIS

Lecture - 3 hrs / week
Paper - 100 marks
Term work - 25 marks

Section – I

1 **Introduction :** (06 hrs.)
Definition of GIS, The origins of GIS, What is CADD? What is AM/FM? What is GIS? Applications, GIS industry and GIS software: GIS software vendors, GIS products, GIS users, GIS services, benefits of GIS, Map data security, Elimination of redundancy, Map revisions, search and analysis of map data, productivity of employees, integration of map data.

2. **GIS Technology Trends:** (02 hrs.)
   Data networks, Data communications, computer hardware, operating system, software engineering.

3. **GIS Data:** (05 hrs.)
   Sources, collection and Entry, Digitizing, GPS surveying, Digital orthophotography, satellite imagery, GIS Data formats and standards, vector data, Raster data, Raster images, DOD spatial Data standards (SDS), spatial data transfer standard (SDTS), Open Geo-data interoperability specification (OGIS).

4. **GIS Analysis, Planning and Implementation:** (07 hrs.)
   Network analysis, Digital terrain modeling and analysis, Grid cell GIS modeling and analysis, GIS plan, Components of GIS plan, phases – planning, analysis, implementation successful implementation of GIS, management support leadership and vision, Data conversion and maintenance, Hardware and software, User training, Data communication, Software customization, User support, Funding.

Section – II

5. **Pitfalls of GIS:** (04 hrs.)
   Failures, outstanding benefits, experimentation, undefined goals, Lack of long term planning and management support, computerizing existing problems, user involvement, Lack of user training and R and D support, Budget overrun/ underestimation etc.

6. **Maintenance and Management of GIS Data base**: (06 hrs.)
   Centralized GIS database, Distributed GIS database, Master and transaction GIS database, Data maintenance issues, Financial and legal aspects of GIS: GIS costs, on going costs, savings, Additional benefits, GIS model for financial justification, Laws for access, pricing, privacy, liability, copyright practice etc.
7. **Remote Sensing:** (08 hrs.)
   Data collection, data types, EM spectrum, radiation and earth, simulated – and earth, simulated – and false-color images, LUT s and band correlation, processing remotely sensed data, rectification, Band stretching, haze corrections, ratios, principal component analysis, image enhancement, edge detection, change detection, GPS data acquisition, classification of remotely sensed data, simple discriminant, supervised and unsupervised. Putting it together, types of data and their uses, conflict resolution, visualization, topical issues.
8. **Case Study:** (02 hrs.)
   Land record, utility management, oil and gas, global change.

Reference Books:

1. The GIS Handbook – By G.B.Korte 5th Edn. Onward press.
2. Geological Information System – By Ian wood, Sarah Cornelius, Steve Carver
3. Remote Sensing Application and Geographic Information Systems Recent Trends – By Muralikrishna I.V. TMH

B.E.(Electronics) - Part- I (Revised)
ELECTIVE – I
iv) REAL TIME SYSTEMS

Lecture - 3 hrs / week

Paper - 100 marks
Term work - 25 marks

Section – I

1. **Issues in real time computing, Structure of real time system, Task classes:** (02 hrs.)
2. **Characterizing Real Time Systems and Tasks :** (03 hrs.)
   Performance measures for real time machines, estimating program run times.
3. **Task Assignment and Scheduling :** (04 hrs.)
   Classical uniprocessed scheduling algorithms, uniprocessor scheduling of IRIS tasks, task assignment, mode changes, fault tolerant scheduling.
4. **Programming Languages and Tools :** (06 hrs.)
   Desired languages characteristics, data typing, control structures, facilitating hierarchical decomposition, packages, run time errors handling, overloading and generics, multitasking, low programming, task scheduling, timing specification, some experimental languages, programming environments, run time support.
5. **Real Time Databases :** (05 hrs.)
   Basic definitions, real time vs general purpose databases, main memory databases, transaction priorities, transaction aborts, concurrency control issues, disk scheduling algorithms, a two phase approach to improve predictability, maintaining serialization consistency, database for hard real time systems.

Section – II

6. **Real Time Communication :** (02 hrs.)
   Network topologies, protocols.
7. **Fault Tolerance Techniques :** (04 hrs.)
   Fault types, fault detection, fault and error containment, redundancy, Data diversity, Reversal checks, malicious or Byzantine failures, Integrated failure handling, Integrated failure handling.
8. **Reliability Evaluation Techniques :** (04 hrs.)
   Reliability models for hardware redundancy, software error models, taking time into account.
9. **Clock Synchronization :** (06 hrs.)
   Clock, nonfault tolerant, synchronization algorithm, impact of faults, fault tolerant, synchronization in hardware, synchronization in software.
10. **Operating Systems :** (04 hrs.)
    Capabilities of real time O.S.

Reference Books:

1. Real Time Systems – By C.M.Krishna, Kang G. Shin (McGraw Hill International Edn.)
2. Real Time Systems – By Jane W.S.Liu, (Peasson Education Asia, 2001).

B.E.(Electronics) - Part- I (Revised)
ELECTIVE – I
v) FUZZY LOGIC

Lecture - 3 hrs / week

Paper - 100 marks
Term work - 25 marks

Section - I

1. Crisp Sets and Fuzzy Sets (4 hrs.)

Crisp sets: and overview, the notion of fuzzy sets, basic concepts of fuzzy sets, classical logic fuzzy logic

2. Operations of Fuzzy Sets: (5 hrs.)

Fuzzy complement, Fuzzy union, Fuzzy intersection, combinations of operations, General aggregation operation.

3. Fuzzy Relations: (6 hrs.)

Crisp and fuzzy relations, Binary relations, Binary relations on single set, Equivalence and similarity relations, compatibility or tolerance relations, ordering morphisms.

4. Fuzzy Measures: (5 hrs.)

Beliefs and plausibility measures, probability measures, possibility and necessity measures, relationship among classes of fuzzy measures.

Section – II

5. Uncertainty and Information: (10 hrs.)

Types of uncertainty, measures of fuzziness, classical measures of uncertainty, measures of dissonance, measures of confusion, measures of non specificity, uncertainty and information, information and complexity, principles of uncertainty and information.

6. Applications: (10 hrs.)

Applications in following area.

1. Natural, life and social sciences
2. Engineering
3. Medicine.
4. Management and decision making
5. Computer science
6. System science
7. Other applications.

Text Books

1. Fuzzy Sets, Uncertainty and Information – George Klir & Tina Floger (PHI)
2. An introduction to Fuzzy Control – By D. Drainkov, Hellendoom Narosa Publication.

B.E.(Electronics) Part- -I (Revised)
PROJECT

Practical - 4 hrs / week

Term work - 25 marks
Oral - 50 marks

The project work is to be carried out in two semesters of B.E.(Electronics) Part – I & Part– II. The practical batch for project will be of 15 students. The batch will be preferably divided into groups each consisting of not more than 3 students.

In semester – I, group will select a project with the approval of the guide and submit the synopsis of project in the month of August. The group is expected to complete details system design, layout etc. in semester – I, as a part of term work in the form of a joint report. In addition all students of project group will deliver the seminar on the proposed project only.

SHIVAJI UNIVERSITY, KOLHAPUR

(Introduced from June, 2005)

B.E.(Electronics) - Part- II (Revised)

1. AUDIO And VIDEO ENGINEERING

Lecture - 4 hrs / week
Practical - 2 hrs / week

Paper - 100 marks
Term work - 25 marks
POE - 50 marks

Section I

1. Principle of disc recording, principle of disc reproduction, Block diagram of disc reproduction system, Coarse-grooves and micro grooves, construction of cutter stylus, Play back needles, cartridges of pick up units, principle of magnetic recording and reproduction, Recorded wavelength, Gap-width and tape speed, need for biasing DC And& AC biasing, Parts of tape recorder, tape transport mechanism advantages and disadvantages of tape recording, Block diagram tape recording and reproducing system Wow and flutter distortions, Rumble, Hissing noise, Types of optical recording of sound, methods of optical recording of sound on films. (7 hrs.)

2. Multimedia Definition, Elements of multimedia system, need of multimedia audio application, audio capture, compression, standards Video applications, video capture Television, compression, standards, proprietary compression (6 hrs.)

3. Introduction to video system, sound and picture transmission, scanning process, camera pickup devices, camcoder, video signal, aspect ratio, horizontal and vertical resolution, video bandwidth and interlaced scanning composite video signal for monochrome TV video signal standards, sound and video modulation, VSB transmission and reception (CCIR – B standards), composite color signals, compatibility TV transmitter block diagrams. (6 hrs.)

4. Composite color signal introduction, colour spectrum, compatibility considerations, chromaticity diagram, colour TV signals, luminance signal, chrominance signal recombination to natural colour voltages, interleaving process, colour subcarrier frequency, colour picture tube, shadow mask, gun assembly, in-line guns, precision in line colour picture tube, colour picture tube requirements, degaussing, purity convergence, circuit colour receivers set up procedure, trouble in colour picture tube. (7 hrs.)

Section II

5. Colour TV systems, elements of NTSC colour system, Basic colour TV transmitters, (NTSC and PAL), basic parameters of SECAM system, SECAM coder and decoder, line by line switch and colour identification circuit, delay line, basic features of PAL system, PAL coder and decoder, colour pixel video signal (PAL). (6 hrs.)

6 Colour TV receivers, antenna, RF tuner, AFT, video IF amplifier, video detector sound section, first video amplifier delay line colour burst circuit, AGC amplifier, phase discriminator, phase identification amplifier and colour killer, reference oscillator, vertical deflection system, horizontal deflection system, EHT. (6 hrs.)

7. Teletext and view data, data input, Teletext systems, suitable equipments, scope of Teletext, using and broadcasting Teletext, closed captioning, Teletext waveforms, Teletext in future, in text view data, (6 hrs.)

8. High definition TV, satellite TV, cable TV working of block converter, Introduction to digital television, how digital television works, Remote control (6 hrs.)

Reference Books :

1. Multimedia in Practice Technology and Applications
   By Judith Jeffcoate (PHI)
2. Audio-Video Engineering
   By Gupta
3. Television and Video Engineering
   By A.M.Dhake
4. Colour Television Theory and Practice
   By R.R.Gulati
5. Basic Television and Video Systems
   By Bernord Grob
6. Communication Electronics
   By Frenzel
7. Electronic Communication Systems
   By George Kennedy

B.E.(Electronics) - Part-II (Revised)
2. MICROWAVE ENGINEERING

Lecture - 4 hrs / week	Paper - 100 marks
Practical - 2 hrs / week	Term work - 25 marks

Section I

01. Review of Electromagnetic Field Theory and Microwave Fundamentals: (03 hrs.)
Interaction between electrons and field, electromagnetic plane waves, microwave frequencies and microwave devices.

02. Microwave Transmission lines: (03 hrs.)
Line equations ad solutions, reflection coefficient and transmission coefficient, standing waves and standing wave ratio, line impedance and admittance, smith chart and impedance matching, microwave coaxial connectors.

03. Wave Guides : (06 hrs.)
Rectangular and circular wave guides, TE and TM mode wave, power transmission in wave guide, power losses I wave guide, excitation of modes in wave guide, characteristics of standard wave guides.

04. Microwave Components and Devices : (06 hrs.)
Microwave cavities, microwave hybrid circuits, directional coupler, circulators and isolators, klystrons, reflex klystrons TWTs.

05. Microwave Crossed Field Tubes : (02 hrs.)
Magnetons, forward wave crossed field amplifier (FWCFA), m-carcinotron oscillators, high power gyrotrons.

Section II

06. Microwave Solid State Devices : (06 hrs.)
Microwave transistors, microwave tunnel diodes, microwave FETs, gunn effect diodes, LSA diodes, InP iodes, CdTe diodes, analanche transit time devices, Impatt diodes, PIN diodes, laser processes, ruby laser, pocket cell laser modulators, microwaver BJTs, HBTs, MESFETs and HFET.

07. Microwave Integrated Circuits : (04 hrs.)
Materials, fabrications, hybrid microave I.C.

08. Microwave Enclosures and Hazards : (04 hrs.)
Electromagnetic compatibility, plane wave propagation in shielded rooms, in anechoic chambers, microwave lean room microwave hazards.

09. Microwave Measurements and Computations : (05 hrs.)
Unit of measurements free space attenuation, conversion of transmitting and receiving power to electric field intensity, conversion of receiving voltage to electric field intensity.

Text Books –

01. Microwave Devices and Circuit – Samul Liao (Prentice hall of India)

Reference Books –

01. Fundamentals of Microwave Engg. – Peter A. Rizzim Prentice hall of India.
02. Foundation for Microwave Engg. – R.E.Collin, Mcgraw Hill International.
03. Microwave Circuits and Passive Devices – Sisodia and Raghuvanshi Wiley Eastern.
04. Microwave Devices and Circuits – Lieo, PHI
05. Principles of Electromagnetic Compativility – B.E. Keuserm Artech
06. Antenna Engineering Handbook – Jasik, Mcgraw Hill
07. Microwave Circuits – Analysis and computer aided design – Vincene F.Fusco, PHI
08. Principles of Radar Engineering – Skolnik, TMH
09. Microwave Active Devices vaccum and solid state – M.L. Sisodia
10. Microwave: Introduction to Circuit Devices and Antenna – M.L. Sisodia and Vijay Laxmi Gupta.

B.E.(Electronics) - Part-II (Revised)
3. COMPUTER NETWORK

Lecture - 4 hrs / week	Paper - 100 marks
Practical - 2 hrs / week	Term work - 25 marks
	OE - 50 marks

Section – I

1. **Introduction in Computer Networks and Devices** **(04 hrs.)**
Structure of communication network, Point to point and multidrop circuits, Network topologies, Hub, switch, router, bridges, additional network components.

2. **Network Models** **(08 hrs.)**
Network software, OSI reference model, TCP/IP reference model, comparison of OSI and TCP/IP model, ARPANET, Internet and its main applications, SMDS, X 25 networks, Frame relay, Broadband ISDN and ATM and its reference model.

3. **Physical Layer** **(4 hrs)**
Transmission media, wireless transmission, modems, RS – 232C serial interface.

4. **Data Link Layer** **(08 hrs)**
a) Classification of communication protocols,
b) Data link layer design issues, Elementary data link protocols, HDLC and SDLC.

Section – II

5. **Medium Access Sub layers** **(8 hrs.)**

The Channel allocation problem, multiple access protocols, IEEE standard 80 for LAN's Bridges, High speed LAN's

6. **Network Layer** **(8 hrs.)**
Network layer design issues, routing algorithms, congestion control algorithms.

7. **Internet Working** **(4 hrs.)**
Concatenated virtual circuits, connectionless internetworking, tunneling, Internet work routing, fragmentation, and firewalls.

List of Experiments (Minimum 8 experiments)

1. Use of RS – 232C for character transfer (Half duplex, Full duplex)
2. Use of RS – 232C for file transfer between two personal computers (Half duplex, Full duplex)
3. Interconnection of personal computers and PSTN (Public switching Telephone Networks) using MODEMS.
4. Finite state machine design (Tutorial type)
5. Implementation of BIT stuffing.
6. Implementation of Stop and wait protocol
7. Implementation of Go Back N protocol
8. Implementation of Selective repeat protocol
9. Sliding window protocols using RS 232c.
10. Implementation error detection method.
    a. Hamming code.
    b. CRC method.
11. Shortest path routing algorithm (By simulation)
12. Optional path routing algorithm (By simulation)

Reference Books:

1. Computer Network (Third Edition)
   By A.S.Tanenbaum (Prentice-Hall of India)
2. Computer Network (Second Edition)
   By Uyless Black (Prentice-Hall of India)

B.E.(Electronics) - Part-II (Revised)
ELECTIVE – II
i) NEURAL NETWORKS

Lecture - 4 hrs / week

Paper - 100 marks
Term work - 25 marks

Section – I

1. Artificial Neural Systems Preliminaries: (03 hrs.)
Neural computation: some examples and applications.

2. Fundamental Concepts and Models of Artificial Neural Systems: (08 hrs.)
Biological neurons and their artificial models, models of ANN, neural processing, learning and adoption, neural learning rules.

3. Single-layer Perception Classifiers: (10 hrs.)
Classification model, features and decision regions, discriminant functions, linear machine and minimum distance classification, non parametric training concept, training and classification using the discrete perception, single layer continuous perception networks, multi-category single layer perception networks.

4. Multi-layer Feed-forward Networks: (03 hrs.)
Linearly non-separable pattern classification, delta learning rule for multi-perception layer.

Section – II

5. Feed-forward recall and error back propagation training, learning factors, classifying and experts layered networks. (06 hrs.)

6. Single Layer Feedback Networks: (06 hrs.)
Basic concepts of dynamic systems, mathematical foundations of discrete time hopfield networks, mathematical foundations of gradient type hopfield network.

7. Application of neural algorithms and systems of printed and hand written character recognition. (03 hrs.)

8. Neural network implementation: (09 hrs.)
Overview of actual systems, integrated circuit synoptic connections. Current mirror and current comparator as active building block, template matching networks.

Text Books

1. Introduction to Artificial Neural System – By Jacek M. Zurada. (Jaico Pub. House)

B.E.(Electronics) - Part-II (Revised)
ELECTIVE – II
ii) IMAGE PROCESSING

Lecture - 4 hrs / week

Paper - 100 marks
Term work - 25 marks

Section – I

1. **Introduction** **(5 hrs.)**
Digital Image representation, steps in Image processing, Elements of IP system, Frame Grabber, Digital camera, Elements of visual perception, Image model, Sample and Quantization, Basic relationship between pixels, Image Geometry.

2. **Image Transforms** **(7 hrs)**
Introduction to Fourier Transform, DFT, Properties of 2-D fourier transform, FET, Walsh transform, Hazard Transform, Discrete Cosine transform, Harr transform, Wavelet transform.

3. **Image Enhancement** **(5 hrs.)**
Spatial and Frequency domain methods, Enhancement by point processing, Spatial filtering, Colour Image processing.

4. **Image Restoration** **(5 hrs.)**
Degradation model, Diagonalization of circulant and block circulant matrices, Algebraic approach, inverse filtering, Least Mean Square filter, constrained Least square restoration, Restoration in spatial domain, geometric Transformation.

Section - II

5. **Image Compression** **(5 hrs.)**
Redundance, Image compression models, Elements of Information theory, Error-Free compression, Lossy compression, compression standards: JPEG & MPEG

6. **Image Segmentation** **(5 hrs.)**
Detection of Discontinuities, Edge linking and Boundary detection, Thresholding, Region oriented segmentation, use of motion in segmentation.

7. **Representation and Description** **(4 hrs.)**
Representation schemes, Boundary descriptors, Regional descriptors, Morphology.

Reference Books :

1. R.C.Gonzalez and R.E.Woods, “Digital Image Processing”, Addison-Wesley Longman, Inc, 1999
2. A.K.Jain, “Digital Image Processing”, PHL
3. M.Sonka, V.Hlavac, and R.Boyle – Image processing, Analysis and Machine vision, Thomson Asia pvt. Ltd, 1999.

B.E.(Electronics) Part--II (Revised)
ELECTIVE – II
iii) MECHATRONICS

Lecture - 4 hrs / week

Paper - 100 marks
Term work - 25 marks

Section I

1. Introduction: (8 hrs.)

Definition, Trends, Control Systems, Microprocessor/Micro controller based controllers, PC based controllers, proportional/Integral/Differential controllers, PID Controllers, Digital Controllers, Adaptive Controller.

2. Electromechanical Drives: (5 hrs.)
DC Servo motors, 4-quadrant servo drives, braking methods, Bipolar drives, MOSFET Drivers, SCR Drives, variable frequency drives.

3. PLC Controllers: (5 hrs.)
Ladder diagram, FSD structured programming, Interfacing of Sensors and Actuators to PLC.

4. Programmable Motion Controllers: (4 hrs.)
Interpolation: point-to-point, Linear Circular, B-S plane, Home, Record position.

Section II

5. Precision Mechanical Actuation:
Pneumatic Actuators, Electro-pneumatic Actuators, hydraulic Actuators, Electro-hydraulic Actuators, Types of motions, Kinematics, Inverse Kinematics, Timing Belts, Ball Screw and Nut, Linear motion Guides, Linear Bearings, Harmonic Transmission, motor/Drive selection.

6. MEMS : **(**7 hrs)
Overview of MEMS & Microsystems, Typical MEMS & Micro system, products and applications.
Micro sensors and micro actuators : Phototransistors, pressure sensors, thermal sensors, micro grippers, micro motors, micro valves, Micro pumps.
Micro Manufacturing : Bulk Manufacturing, Surface Manufacturing, LIGA Process.

7. Design of Mechatronic Systems : (6hrs)
The design process, traditional and Mechatronic designs. A few case studies like piece counting system pick and place manipulator, simple assembly involving a few parts, part loading. Unloading system, automatic tool and pallet changers etc.

8. Robot & It's Peripherals : **(**6 hrs)

End Effecters – Types, Mechanical Electromagnetic, Pneumatic Grippers, Tool as End effecter, Robot End effecter interface.

Sensors – Sensors in Robotics, Tactile Sensors, proximity and Range Sensors, Sensor based systems and uses, Robot programming.

Term- Work:

1. Interfacing and control of DC Servo motor with Microcontroller for position, speed and direction control.
2. PLC Programming in ladder, FBD, Structured.
3. Study of graphical PID tuning for X-Y position, Study of Rotary and Conveyor.
4. Pneumatic and Hydraulic actuators.
5. Robot programming.
6. CNC Programming.

Reference Books :

1. Mechatronics 2nd Edition – W.Bolton Addison Wesley – 981-235-874-9
2. Mechatronics Principles, Concepts and Applications – N.P. Mahalik TMH – 0-07-0483744.
3. Mechatronics – Dan Necsulescu – Pearson Eduction – 81-7808-676-X.
4. Computer Control of Manufacturing systems-Yoram Koren.-McGraw Hill 0-07-066379-3
5. MEMS and Microsystems Design and Manufacture – Tai – Ran Hsu – TMH 0-07-048709
6. Industrial Robotics : Technology, Programming and Applications – Grover,Weiss,Nagel,Ordey(Mcgraw Hill)
7. Robotics : Controls,Sensing,Vision and Intelligence – Fu,Gonzalez, Lee (Mcgraw Hill)
8. Robotics Technology and Flexible Automation – S.R.Deb (TMH)

B.E.(Electronics) Part--II (Revised)
ELECTIVE – II
iv) INFORMATION TECHNOLOGY

Lecture - 4 hrs / week

Paper - 100 marks
Term work - 25 marks

Section I

1. Information Technology : (6hrs)
Concepts and management, Definition, Classification, Transactional and functional processing, Information infrastructure and Architecture, Managing Information Resources.

2. Strategic Information System : (5hrs)
Strategic Advantage, Porter's Competitive Forces Model and strategies, Porter's value chain Analysis Model, Frameworks, Framework for global Competition Applications.

3. Electronic Commerce : (5hrs)
Foundations, Markets, Business to Consumer Applications, Business to Business Applications, Customers, Market Research, Support, infrastructure, Payments, Support Services.

4. System Development : (4hrs)
Life Cycle, System development outside the IS Department, Important Systems Development issues, Protecting Information Systems, Managing the IS Department.

Section II

5. Multimedia : (10hrs)
Introduction of multimedia, Multimedia Hardware and Software, Basic Software tools, Making instant multimedia, multimedia authoring tool.

6. Multimedia Building Blocks : (10hrs)
Text, Sound, Images, Animation, Video.

Text Books

1. Information Technology for management (for chapter 1,2,3,4) _ Turban, Mclean, Wetherbe (Wiley publications)
2. Multimedia Making it Work (for chapter 4 and 5) – Tay Vaughan (Tata Mcraw Hill 5th edition).

Reference Books:

1. IT Encylclopedia.com – 2nd revised edition, 5th book.
2. Multimedia System Design – 3rd edition –Prabhat K. Andleigh, Kiran Thakrar, Prentice Hall of India.

B.E.(Electronics) Part--II (Revised)
ELECTIVE – II
v) BROADBAND COMMUNICATION

Lecture - 4 hrs / week
Paper - 100 marks
Term work - 25 marks

Section I

1. **Introduction:** **(4 hrs)**
   What is communication network, telecommunication network, switching technologies, what is broadband, the need for broadband, over view of broadband technologies.

2. **Evolution of BOSDN:** **(3 hrs)**
   Overview drives for BISDN, building blocks of BISDN.

3. **FDDI & DQDB:** **(3 hrs)**
   Overview, fiber distributed data interface, distributed queue dual bus.

4. **Frame relay:** **(6 hrs)**
   Overview, frame relay standards, Frame relay field formats, frame relay architecture, how does frame relay work, frame relay services and features, frame relay applications.

5. **SMDS:** **(4 hrs)**
   Overview, SMDS standards, SMDS architecture, how does SMDS work, SMDS features and services.

Section – II

6. **ATM:** **(4 hrs.)**
   Overview, the ATM principle, ATM protocol, how does ATM work, ATM application environment.

7. **BISDN Lower Layers:** **(8 hrs)**
   Overview, broadband protocol references model, broadband functional architecture, physical layer of BISDN, ATM layer of BISDN, and ATM adaption layer of BISDN protocol.

8. **BISDN higher layers:** **(4 hrs)**
   Overview, management plane, user plane, control or signaling plane.

9. **Other aspects of BISDN:** **(4 hrs)**
   Broadcast service aspects, network aspects, user network interface aspects.

Reference Books :

1. Broadcast communications – Balaji Kumar (McGraw Hill Inc.)
2. ISDN – An Introduction – W. Stallings (McGraw Publishing company.)
3. Telecommunication Network – M.Schwartz (Addison Wesley pub.)
4. Computer Communication network – Design & Analysis – M. Schwartz (PHI publication).

B.E.(Electronics) Part--II (Revised)
ELECTIVE – II
vi) SYSTEM ON CHIP

Lecture - 4 hrs / week

Paper - 100 marks
Term work - 25 marks

Section I

1. **Introduction to the concept of a SOC** **(8 hrs)**
   Backgrounder, microprocessor and Microcontroller based systems, Embedded systems.
   Differences between Embedded systems and SOCs.
2. **System design** **(12hrs)**
   Concept of system, importance of system architectures, introduction to SIMD, SSID, MIMD and MISD architectures, concept of pipelining and parallelism.
   Designing microprocessor /Microcontroller based system and embedded system.
   System design issues in SOCs.

Section II

3. **System buses** **(6 hrs)**
   Introduction to busses used in SOCs. Introduction to AMBA bus.
   Detailed study of IBM's core connect bus, concept of PLB-processor local bus and OPB-on chip peripheral bus.
4. **Processors used in SOCs** **(6 hrs)**
   Introduction to CISC ,RISC, Von Neuman and Harward Architecture.
   Concept of Soft processors and study of Microblaze RISC processor.
   Study of IBM's power PC
5. **SOC implementation** **(8 hrs)**
   Backgrounder – programmable logic and FPGA Architecture .
   Concept of embedded processors and study of virtex II PRO Architecture.
   Study of features like embedded RAMs ,multipliers ,Digital clock management etc.

* **Introduction to tools used for SOC design, Xilinx embedded development kit**
Labs-Tutorials

- SOC system design tutorial-designing an image processing system with interface to host using either UART/PCI/USB bus.
- Developing simple systems by interfacing simple peripherals to virtex II pro.

Tools : Xilinx ISE and Xilinx EDK Latest versions

Reference Books :

1) FPGA based system design by Wyne wolf – published by prentice hall.
2) Readings in hardware/software co-design Giovanni De Micheli,Rolf Ernst, and Wayne Wolf – published by Morgan Kaufman.
3) Computers as components:principles of embedded computing system design published by Morgan Kaufman publishers
4) Multiprocessors systems-on-chips by Ahmed jerrya wayne wolf,eds-Morgan Kaufman publishers

5) Core connect architecture at http://www.chips .IBM.com/products/coreconnect
6) EDK power PC tutorial at http://www.xilinx.com/EDK
7) Virtexll pro handbook from xilinx
8) Power PC info http://www.chips .IBM.com/products power PC/cores/405sde_pb.html.
9) White papers form xilinx.com and http://www.chips .ibm.com
10) Arm processor details at WWW.arm.com
11) Amba bus architecture at at http://www.arm.com/products/solutions/Ambahomepage.html http://www.princeton.edu/~wolf

PROJECT-II

B.E.(Electronics) Part--II (Revised)

Lecture - 8hrs / week

Term work - 50 marks
Oral - 150 marks

The Project group in semester I will continue. the project work in Semester- II and complete project in all respect (assembly, testing, fabrication, tabulation, test result etc.) The project work along with project report should be submitted as part of term work in Semester- II on or before the last day of the semester -II.

SAWANT S. P. **BIRJE SR**

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