University of Pune
Syllabus for Electronics subject of
F.Y. B.Sc. (Computer Science)
(To be implemented from June 2008)

PAPER I: ELECTRONIC DEVICES, CIRCUITS AND COMPUTER PERIPHERALS

UNIT 1: DC circuit analysis **(06)**

Revision of Ohm's law , Kirchoff's current and voltage law , concept of current source, voltage source ; application of Kirchoff's current and voltage law to simple circuits like potential divider circuit ; Superposition Theorem ; concept of equivalent circuits; Thevenin's Theorem ; Norton's Theorem .

UNIT 2: Semiconductor Diode **(06)**

Formation of p-n junction; structure, working and parameters of: rectifier diode, Zener diode, photodiode and LED.
Applications - optocoupler, dot matrix display of LED, 7 segment display.

UNIT 3: Bipolar Junction Transistor **(08)**

Structure and working of bipolar junction transistor; CB, CC, CE configurations; CE mode characteristics; relation between α and β.
Concept of transistor as an amplifier and transistor as a switch - potential divider Biasing, DC load line and Q point.
Applications – Audio amplifier, use of transistor to switch LED

UNIT 4: Field Effect Transistor **(08)**

Structure and working of: JFET, low power MOSFET (Enhancement and Depletion): I-V characteristics and parameters (transconductance, drain resistance, pinch of voltage, amplification factor); advantages of FET.
Idea of MOS capacitor, memory device, CMOS.
Applications: FET as -Voltage Variable resistance (VVR), inverter, switch, DRAM.

UNIT 5: Amplifier **(12)**

General classification of amplifier based on frequency response and Q point; idea of multistage amplifier; Concept of DC coupling and effect on frequency response; concept of feedback.
Concept of operational amplifier (black box level); ideal characteristics of Opamp; Opamp as comparator; Virtual ground concept.
Applications: Unity gain amplifier, buffer, inverting amplifier, non-inverting amplifier, Adder, subtractor, integrator and differentiator.

UNIT 6: Oscillator **(04)**

Concept; Barkhausen criteria; phase shift oscillator using opamp; Hartley oscillator; Colppits oscillator.

UNIT 7: Power Supply **(10)**

Concept and working of rectifier (Half, Full, Bridge) ; ripple voltage ; RC filter circuit ; Unregulated and regulated power supply ; concept of load and line regulation ; Zener as regulator ; 3- pin positive and negative voltage regulator ; use of heat sink ; SMPS block diagram ; UPS : online and offline (block diagram and different parameters) ; principle of - spike protector, CVT.

UNIT 8: Electronics in Computer System

a) Motherboard : CPU and other components **(02)**
b) Input devices : Keyboard, mouse, joystick , scanner, digitizer. Light pen , touch screen ,CCD camera. **(06)**
c) Output devices : CRT, LCD, Plasma display , printer : DOT matrix, Ink jet & LASER, sound devices, ear phone **(06)**
d) Storage devices : HDD, CD, DVD, pen drive,. **(04)**

RECOMMANDED BOOKS:

1. Principles of Electronics: A.P.MALVINO, Tata Mc-Graw Hill Publication, 7th Edition.
2. Basic Solid State Electronics: B.L. Theraja, S.Chand & Company Ltd, 1997 reprint.
3. IBM PC AND CLONES , Hardware , troubleshooting and Maintenance : B GOVINDARAJALU , Tata McGraw Hill Publishing company.
4. Principles of Electronics: V.K. Meheta, S.Chand & company Ltd. 5th Edition
5. Basic Electronics and Linear Circuits : N N Bhargava , D C Kulshreshtha , S C Gupta , Tata McGraw Hill Publishing company
6. Electronic Devices and circuits: Boylstead, Tata Mc-Graw Hill
7. Mike Meyers A+ Guide to managing and troubleshooting PC's : Mike Meyers and Scottgernigan, Tata Mc-Graw Hill

Paper II FUNDAMENTALS OF DIGITAL ELECTRONICS

Note: Reference to commercial available IC's is to be made while teaching the course.

UNIT 1: Data representation and Arithmetic for Computers (08)

Binary, Octal, Hexadecimal Number system ; Interconversion from one system to another , BCD code, Gray code, Excess-3 code, ASCII code, Concept of parity.
Signed and unsigned numbers , 1's complement and 2's complement of binary numbers and binary arithmetic.

UNIT 2: Logic Gates (08)

Concept of Logic gates – statement, symbol, expression and truth table of basic and universal logic gates;
Derived logic gates- statement, symbol, expression and truth table of derived gates EXOR, EXNOR.
Boolean algebra and identities; De Morgan's theorem and Interconversion of logic gates; Simplifications of logic expressions using a) Boolean algebra, b) K-map.
Introduction to logic families; TTL NAND gate , input output parameters, tristate logic, fan in, fan out, propagation delay, noise margin.

UNIT 3: Combinational Circuits (12)

Half adder, Full adder, half subtractor, Parallel adder, nibble Adder; Arithmetic logic unit, Encoder, Decoder, Multiplexer, and De multiplexer, concept of analog multiplexer.

UNIT 4: Sequential circuits (12)

Concept of sequential circuits ;Latch , Flip-flops **:** RS, clocked RS, JK, Master Slave JK, T, D, Counter - synchronous, asynchronous, up-down counter, modulo –N counter, decade counter (IC 7490); shift register (IC 7495), ring counter, Johnson counter; Design of sequential circuits , random sequence generator.

UNIT 5: Multivibrator (06)

Block diagram of IC 555; Application of IC 555 as Astable, Bistable and Monostable Multivibrator, Crystal clock using inverter.

UNIT 6: Memory devices and memory Organization (10)

Types of Memory - volatile and nonvolatile, SRAM and DRAM, Classification and working principle of memory devices ; RAM, ROM, PROM, EPROM, EEPROM ; Concept of Diode Matrix ROM, speed and cost range of memory devices, Memory organization –building the required memory size by using available memory chips, memory address map, tristate buffer

UNIT 7: Data Converters (06)

DAC –Binary weighted, R-2R; ADC - Single slope and Dual slope, flash ADC, parameters of ADC and DAC.

UNIT 8: Processors and Machine language for computer (10)

Processors in computing applications: PCs - Desktop, Laptop , servers, supercomputers, embedded computers [80xx intel family , ASIC , CSIC , RISC , SIMD , ARM , AVR , PIC only at introduction level]

Computer programming languages and executions – Machine level , Assembly, higher level , Assembler , interpreter and compiler concept.

RECOMMANDED BOOKS:

1. Digital principals and applications: Malvino Leach, Tata McGraw Hill, 4th Edition
2. Fundamentals of Digital Electronics: A.Anand Kumar PHI Publications 2001
3. Digital Principles: T.L. Floyd 3rd edition
4. Digital Electronics: C.F.Strangio
5. Modern digital Electronics: R.P.Jain, Tata Mc-Graw Hill Publication
6. Digital logic and computer design-Morris Mano
7. First course in Digital System Design: John P. Uyemura, Brooke/Cole, Thompson Learning (2001)
8. Computer Organisaztion Design , The hardware/Software Interface , David A. Patterson and John L. Hennessy , Morgan Kaufmann Publisher , 3rd Edition
9. Programming and Customizing the 8051 Microcontroller , Myke Predko , Tata McGraw Hill publishing.
10. Embedded system , Rajkamal
11. Embedded system design, F. Vahid,T. Gargivis John Wiley and Sons
12. An Introduction to the Intel family Microprocessors A hands on Apprach utilizing the 80x86 microprocessor family. , James Antonakos m Person Educatrion Asia
13. IBM PC Assembly Language and Programming , Peter Abel , Prentece Hall of India .

Paper III - Practical Course

List of experiments in Electronics at FYBSc Computer Science

1. The practical course consists of overall 20 experiments.
2. Any two of the following activities with proper documentation under guidance of practical teacher incharge will be considered as equivalent of 4 experiments Weightage in term work.
   These will be evaluated in an oral examination for 20% marks at internal and annual examination.
   i. preparatory experiments
   ii. Information collection (Computer related Hardware / Software)
   iii. Industrial visit / live work experience
   iv. Hobby project
   v. Seminar / presentation of self study topic

Duly certified report of any two activities performed must be presented along with journal.

3. All the students are required to complete minimum of 16 experiments (Four from each group) from the following list.

Group A Any Four

1. To verify Thevenin, Norton theorem for a resistive circuit.
2. To study forward bias characteristic of rectifier diode.
3. Study of breakdown characteristic and voltage regulation action of Zener diode
4. Study of output and transfer characteristic JFET/MOSFET
5. Study of output characteristics of Bipolar Junction Transistor in CE mode
6. Study of potential divide bias circuit for bipolar junction transistor.
7. To study CMOS inverter circuit.
8. To study single Stage RC coupled CE amplifier characteristics

Group B Any Four

1. To design and test FET as constant current source.
2. To study transistor as a switch.
3. To design, build and test adder, subtractor circuit using opamp IC 741.
4. To design, build & test integrator and differentiator circuit using opamp IC 741.
5. To design, build and test phase shift oscillator using opamp.
6. To study half wave, full wave and bridge rectifier circuits with RC filters.
7. To study three Pin regulated power supply using IC 7805, IC 7905.
8. To study Switching Mode Power Supply.

Group C Any Four

1. Study of discrete basic Logic gate circuits and logic gate IC's.
2. Interconversion of Logic gates using De'Morgans Theorem.
3. Study of Half adder and Full adder circuit using logic gates.
4. To study two nibble adder and subtractor circuit using IC's.
5. To design build and test parity generator
6. Study of Multiplexer and Demultiplexer.
7. Study of Flip Flop: RS, Clocked RS, D.
8. To design build and test astable Multivibrator circuit using IC 555

Group D Any Four

1. Study of scaling circuit IC 7490
2. Study of Shift register IC 7495
3. To study crystal oscillator using inverter logic gate.
4. To study Thumb Wheel Switch Interface IC 7447 with 7 segment display.
5. To study Diode Matrix ROM using decoder 74138.
6. To design, build and test digital code lock using logic gates.
7. Study of 4-bit DAC using R-2R ladder network
8. Study of flash ADC.

Any Two Activities from the following (Equivalent to 4 Experiments)

A) Preparatory experiments (Any two of these)

1. Identification of components / Tools
   - Minimum 10 different types of components must be given
   - Identification based on visual inspection / data sheets be carried out

2. Use of Multimeter
   - Measurement of AC/DC voltage and Current – on different ranges
   - Measurement of Resistance and capacitance
   - Testing of Diodes and transistors.
   - Measurement of h_{fe}
   - Use of Multimeter in measurement of Variation of Resistance of LDR and Thermister (graph expected)
3. Study of Signal Generator and CRO
   - Understand how to use Signal Generator and CRO
   - Study of Front panel controls
   - Measurement of amplitude and frequency of Sine ,Square waveform
   - Measurement of Phase with the help of RC circuit
   - Demonstrate the use of Component test Facility

4. Study of working principle and operation of floppy disc drive, CD drive, HDD.

5. Study of working principle and operation of various printers, mouse.

6. Study of various mother boards, IC chipset etc.

B) Information collection (Computer related Hardware / Software)

Any two of these

Collect the information about software or hardware that is used in most of the applications or it is recent one.

WAP, RFID. GSM. CDMA, TAPI, Mobile communication, Network administration and security, DSP, e-commerce, WI-Fi, Wi-Max, IVR

C) Industrial visit / live work experience

Visit to an industry or commercial exhibition or experience of work in any company

D) Hobby project:

Any one miniature project regarding use of electronics / computer in it under guidance of the teacher.

E) Seminar / presentation of self study topic:

Any one topic approved by the teacher with proper collection of matter and presentation.

GUIDELINES FOR ACIVITIES FOR PRACTICAL COURSE

Preparatory experiments will help student to gain knowledge needed as a base to perform main experiments. It will prepare student for practical course.

1. **Preparatory experiments**

Aim of practical – i) Student should be familiar with components , its types ,specifications , data sheets etc.
ii) Know various Test and Measurement instruments
iii) Use of various Test and Measuring Instruments

Scope :-

a. Read reference books , technical reviews etc
b. Refer data manuals
c. Refer electronic magazine s , news papers etc
d. Visit to various labs for test and measuring instruments used in it.
e. Whenever he performs other experiments note down the important about above components , test and n\measuring instruments etc.
f. Instead of limited knowledge in laboratory or noncredit practical experiment , this method will improve practical knowledge as well as familiarization with electronic subject.

2. Hobby Projects / Open ended Challenges

One practical session should be conducted to teach philosophy behind this experiment. Give explanation of any one gadget in detail . For example Water Level Indication – Requirement, electronic used, practical design , test , improvements , further scope , commercially available controllers with specifications etc. Learn various applications of electronics in real world. Learn Problem understanding , designing , planning , build/test , error remove , packaging , report , demonstration , quality parameters etc.

Either college can provide some gadgets or student can bring for their own purpose . Teacher can prepare case study project , where most of skills will be transferred to the statements like to understand application problem with use of electronics without knowing much of the theory or working of the circuit in detail. (Hence it is a hobby circuit)

In this experimentations instead of providing readymade Kits / PCB / Units Provide the students – Circuit idea , components , Bread board , tag board or any other means (Software simulation) and let us observe ways to work out for result. Aim of the experiment will be fixed , (Like to make oscillator , amplifier , alarm circuit etc) student is free to choose his way to perform experimentation / documentation etc.

3. **Internet search**

Search information related with any topic fronm theory / practical syllabus using internet.
Conclude how Internet helps us in above process.

4. **Industrial visit/ live work experience**

This choice is according to background of the students. If he knows any industry or if he could attend in the industry for work experience of 4-5-days he can write report on live experience in industry , (College should support the necessary documents for various permissions) or group of 2-3 students can also visit / work in an industry and report it properly. Many times student visit s to technical fairs , expo visions they can collect the commercial information regarding electronic products and prepare report on it.

5. **Seminar / presentation of self study topic**

Any relevant topic approved by the teacher with proper collection of matter and presentation in a practical batch one practical activity can be awarded . Proper documentation is to be made for the purpose of examination.

Pattern for Practical Examination –

A) Internal Marks 20 :

16 marks are assigned for experiments, journal and attendance
04 marks for activities .

B) Annual examination : 80 Marks **In Two session of 3 Hrs .**

Session I 40 marks
Practical work 32 marks
Activity performed by the student 8 marks

Session II 40 marks
Practical work 32 marks
Activity performed by the student 8 marks

32 Marks are assigned as -

Circuit diagram	06
Connection	06
Observation ,Demonstration , calculations graph, presentation of experiment	15
Result	05