SOLAPUR UNIVERSITY, SOLAPUR

New syllabus for B.Sc. III Electronics

w. e. f. June 2009

1. Course Structure

Sr. No.	Paper no	Paper Title	No. of lectures	Total Marks.
1.	V	Linear Integrated Circuits	84	100
2.	VI	Instrumentation	84	100
3.	VII	Microcontroller and Embedded system	84	100
4.	VIII	Power and Industrial Electronics	84	100
5.	-	Practical Course		200

2. **Nature of theory question paper**.
   The nature of theory question paper is same as that for B. Sc I and B.Sc II.
   (Each paper of 100marks, Section-I and Section-II each of 50 marks)
3. **Distribution of Practical Marks** (200)
   1. Practical from group A 32
   2. Practical from group B 32
   3. Practical from group C 32
   4. Practical from group D 32
   5. Demonstration Experiment 10
      (Demonstration performance-5marks, Oral-5marks)
   6. Project Work 40
      (Project-20marks, Report- 10marks,oral-10marks)
   7. Seminar 6
   8. Industrial visit/ Industrial Case study /job training/ visit to industrial exhibitation 4
   9. Journal 12

Break of Practical Marks may be as given below.

a) Circuit diagram/ Flow Charts 6
b) Connection / Programming 6
c) Understanding and Working 3
d) Observations/ Execution 8
e) Calculations, graph / printout 4
f) Result / comment 2
g) Oral 3

Demo Experiments: Usually in the curriculum all the experiments related to commercial applications can not be included in the practical course. So as far as recent trends in

Electronics are concerned, few demonstration experiments are included in the syllabus to improve the understanding of the students and practical aspects of the Electronics.
Every student has to show one demonstration experiment at the time of practical examination. The demonstration will be assessed independently for performance and oral at the time of project. (i.e. on the third day of practical examination)

Project: Every student should take up a project and submit in the report, the work he has carried out. The project work will be assessed independently at the time of practical examination. The number students may have same project (Minimum two and maximum three)

Seminar: Every student of B.Sc. III, Electronics will have to deliver one seminar of at least 30 min. on the advanced topic in Electronics and submit the report at the time of examination.

Industrial visit / Local industry case study / Job training/visit to industrial exhibition: In order to give the exposure of industry/ Research Institute and advances in the field of Electronics, industrial visit should be arranged and submit the report. OR he should submit the report of the case study of local industry or job training (minimum four days) OR he may visit to an industrial exhibition.
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B.Sc. III Electronics

Paper V
Linear Integrated Circuits

Section -I

1. Operational Amplifier Fundamentals **8**

Introduction to Op-amp, Characteristics of Ideal op-amp, Block diagram of Op-amp, Equivalent circuit of Op-amp.
Op-amp parameters: I/P bias current, I/P offset current, offset voltages, slew rate, CMRR, PSRR, Effect of temperature on offset voltage, Offset balancing technique,
Frequency response of op-amp, IC 741 and its specifications.

2. Operational Amplifier Linear Systems **10**

Inverting amplifier (dc and ac), Concept of virtual ground, Non-inverting amplifier (dc and ac), Voltage follower, Summing amplifier (adder and subtractor), Current to Voltage and Voltage to Current converter, Differentiator and Integrator, Log and Antilog amplifiers.

3. Operational Amplifier Non-linear Systems **8**

Precision Rectifier (HW & FW), Peak detector, Clipper, Clamper.
Sample and Hold circuit.
Comparators:- Basic comparator, Zero-crossing detector, Window detector, Regenerative comparator (Schmitt Trigger).

4. Active Filters **8**

Advantage of active filters over passive filters, Classification (low pass, high pass, band Pass, band stop and all pass filters), Types of filters (Butterworth and Chebyshev) and their comparison, Second order Butterworth Low pass and High pass filters, Band pass and Band stop filters (narrow).

5. Wave form Generators **8**

Oscillators: Phase shift oscillator, Wien Bridge oscillator.
Multivibrators:- Astable multivibrator, Monostable multivibrator .
Triangular wave generator, Saw tooth generator.

Section - II

6. Regulated Power Supply **8**

Series and Shunt regulator, Basic block diagram of IC regulator, Protection circuits for IC regulators (over current, over voltage, thermal shutdown)
Voltage regulators using IC 723, 78XX, 79XX, LM 317.

7. Phase Locked Loop **8**

VCO, Block diagram of PLL, Principle and working of PLL, Transfer characteristics, Derivation of lock range and capture range.
Study of IC 565, Application of PLL as Frequency multiplier using IC 565,
FM demodulator, FSK demodulator.

8. Data Converters **8**

Basic concepts of ADC and DAC, accuracy and resolution
Digital to analog converter: DAC by using R- 2 R ladder.
Study of IC 0808 / 1408 DAC
Analog to digital converters:- Successive approximation and dual slope technique for ADC. Study of IC 0804 and 0809 ADC.

9. Linear IC's **12**

Study of IC's (Important features, working and applications)

i. FET input op-amp (LF356)
ii. Comparator (LM 311)
iii. Norton's Amplifier (LM3900)
iv. Function Generator (I C 8038)
v. Audio amplifier (LM 380)
vi. V to F and F to V converter (LM 331)
vii. Sample and Hold (LF198)

10. Fabrication of IC's **6**

Advantages of IC's, Epitaxial process.
Fabrication of monolithic components: transistors (npn and pnp), diodes, resistors and Capacitors.
Introduction to VLSI design, fabrication of NMOS

Reference Books:

1. Integrated Electronics – Millman – Halkies (MGH)
2. Op-Amps and Linear circuits – Ramakant Gaikwad (PHI)
3. Operational Amplifiers and Linear ICs – Caughlin and Driscoll (PHI)
4. Linear Integrated Circuit – D Roy Choudhari, Shail Jain (Wiley Eastern Ltd.)
5. Microelectronics Circuits – Rashid (PWS Publication)
6. Integrated Circuit (New Edition) – K. R. Botkar
7. Design with Operational Amplifiers and Analog ICs – Franco (Mc Graw Hill, 2000)
8. Basic VLSI Design- D. A. Pucknell and K. Eshraghian (PHI)

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Paper VI

Instrumentation

Section - I

1. Introduction **4**

Performance characteristics, Standard characteristics, Errors in measurement, Types of error, Sources of error, Dynamic characteristics and response.
Block diagram of generalized measurement system.

2. Sensors and Transducers **14**

Electrical transducers and their parameters, Selection criterion,
Classification of transducers

i. Thermal Sensor: - Thermistor, Thermocouple, RTD and their comparison. (Construction, operation and application)
Semiconductor temperature transducers IC- LM34/LM35, AD590,

ii. Pressure Sensor :- Capacitive, Strain gauge (bounded and unbounded), Load cell, Piezoelectric Sensor
(Construction, operation and application)

iii. Displacement Sensor:- Linear (Resistive), Angular (Capacitive), LVDT.
(Construction, operation and application)

iv. Radiation Sensor:- LDR , Photodiode , Phototransistor, Photovoltaic cell (solar cell)
(Construction, operation and application)

v. Chemical Sensor:- pH sensor , Conductivity sensor, Gas sensor.
(Construction, operation and application)

3. Display and Recorders **6**

LED display, LCD display, X-T recorder, X-Y recorder,
Magnetic tape recorder, Digital recorder.

4. Signal Conditioning **9**

Block diagram of DC and AC signal conditioning system.
Differential amplifier using FET input Op-amp, Bridge amplifier, Feed-back amplifier, Instrumentation amplifier, Input isolation.

Generalized system design with signal conditioning circuits for calibration of sensor (Output voltage 0 to 2V) for LDR, RTD and Load cell transducers.

5. Data Acquisition System **9**

Objective of DAS, Single channel DAS, Multi-channel DAS, Data Logger
Generalized System design with signal conditioning circuits for temperature controller (continuous monitoring) with ADC/DAC interface to PC.

Section II

6. Test and Measuring Instruments **10**

Digital voltmeter (Dual slope ADC), Digital Multimeter, Function generator, Digital frequency meter, Analog Oscilloscope.

(Operating principle, Block schematic, Working, Uses and Limitation)

7. Analytical Instruments **6**

Introduction to analytical measurements, Digital pH meter, Digital conductivity meter, Calorimeter.

(Operating principle, Block schematic, Working, Uses and Limitation)

8. Biomedical Instruments **8**

Sources of bio-potential, ECG, EEG, EMG.

(Operating principle, Block schematic, Working, Uses and Limitation)

9. Agro based Instruments **8**

Soil salinity tester, Measurement of soil NPK.
Moisture measurement, Temperature recorder.

(Operating principle, Block schematic, Working, Uses and Limitation)

10. Industrial Instruments **10**

Digital Lux meter, Digital tachometer (contact and non contact type),
LCR-Q meter, Digital storage oscilloscope,
Logic analyzer, Spectrum analyzer.

(Operating principle, Block schematic, Working, Uses and Limitation)

Reference Books:

1. Electronic Instrumentation by K S Kalsi , TMH Publication
2. A course in Electrical and Electronic Measurement and Instrumentation by A K Sawheny, Dhanpat rai and Sons Publication
3. Electronic Measurements by U A Bakshi and V U Bakshi, Technical Publication
4. Handbook of Medical Intrumentation by R S Khandpur , TMH publication
5. Handbook of Analytical Instruments by R S Khandpur , TMH publication
6. Principles of Agricultural Engineering Vol. 1 & 2 by A M Michel, T P Ojha, Jain Brothers.
7. Transducers and Display Systems by B. S. Sonde
8. Instruments and Instrumentation Technology by M. M. S. Anand (PHI).
9. Instrumentation Measurement and Analysis by Nakara Choudhary, (TMH).

B.Sc. III Electronics
Paper VII
Microcontroller and Embedded systems
Section – I
(Microprocessor and Microcontroller)

1. Introduction to Microprocessor **4**

Introduction to Microprocessor, organization of microprocessor based systems.
Concept of system bus.
Introduction to programming languages :- Mashine Level Language, Assembly Level Language, Higher Level Lannguage.
Concept of assembler and compiler.

2. Introduction to 8085 Microprocessor **12**

A. Architecture of 8085 microprocessor:- Block diagram, pin description, salient features.
   ALU, registers & flags, Timing & control unit.
   Bus structure, De-multiplexing of AD0 - AD7 lines, Generation of control signals, Reset & clock circuits, Interrupt structure.
B. Introduction to Instruction set:- Machine language Instruction Formats.
   Addressing Modes, Data Transfer operations, Arithmetic Operations, Logical operations, Branching Operations, Machine control instructions.
   (with one example of each using 8085 Instruction set)
C. Typical execution of an Instruction, T-states, Machine Cycle and Instruction execution cycle.
D. A typical example of Assembly Language Programming for 8085.

3. Introduction and Architecture of 8051 Microcontroller **12**

Comparison of microprocessor & microcontroller.
Overview and features of MCS-51 family.
Architecture of 8051 Microcontroller:- Block diagram, Pin description, salient features.
Registers & flags, Internal memory, SFR's, Port structure.
Integrated peripherals such as Timers/counters, Serial port, Interrupt structure.
Reset circuit & Timing details.
Special features of 89V51RD2 / 89S52 (internal memory & protocols)

4. Instruction set of 8051 microcontroller **8**

Study of 8051 Microcontroller Instruction set, classification as per functional category.
Addressing modes of 8051.
Instruction execution and timing.

5. Assembly language programming for 8051 microcontroller **6**

Algorithm, flowchart, structure of assembly language.
Programming for 8051:- Arithmetic and logical operations, Bit-level Boolean operation, Loops, Time delay Subroutine.

Section II
(Interfacing and Embedded Systems)

6. Interfacing **6**

Need of interfacing, Interfacing techniques, Types of I/O,
Tri-state buffer, Line driver(74244), Bidirectional buffer(74245), Octal-D latch(74373), Address decoder(74138).
Interfacing features of EPROM(2764), RAM(6264), PPI 8255.

7. Interfacing to 8051 microcontroller **8**

I/O interfacing concepts:- Port structure, I/O interfacing(reading / writing port).
Interfacing:-LED, switch, relay, optocoupler, 7-segment display, LCD(16*2), matrix keyboard.
Memory expansion:- EPROM(2764), RAM(6264) interfacing.
I/O expansion:- 8255 interfacing.

8. Fundamentals of 'C' programming **12**

A. Introduction to 'C' Programming. The Structure of C Program, Character set, Keywords and identifiers, Constants & Variables, Data types & data ranges Expressions & Operators.
B. Statements:- i. Control:- if, if-else, goto, case, break and continue.
ii Loop:-for, while, do while.
C. Array:- Definition, One dimensional and two dimensional arrays.
D. Functions:- Definition, call by value and call by reference.
(Simple programming examples)

10. Embedded 'C' programming for Microcontroller **12**

Structure of embedded C program.
A. Development tools:- Introduction to various development tools, Need of IDE.
Brief study of development tool (Kiel Micro-vision 3).
B. Programming tools:- Programming the microcontroller, Programming tool, flash magic,
In-System Programming(ISP).
C. Programming the MCS51:- Embedded C programs for I/O port handling (Bit & byte level).
Time delay (with & without use of timer).

11. Applications **4**

Waveform generator using DAC (0808/1408) interface for 8051.
Stepper motor controller using 8051.
Development embedded system for temperature measurement.

Reference Books:

1. Microprocessor Architecture , Programming and Applications – (New edtion) – R. S. Gaonkar (Wiley Ester Ltd)
2. Microprocessor : Principle and applications – Ajit Pal , TMH
3. Digital Systems and Microprocessors , D. Hall (TMH)

4. Microprocessor and Microcomputer based system Desing – M. Rafiquzzaman (UBS), New Delhi.
5. Fundamentals of Microprocessor and Microcomputer – B Ram (Dhanapat Rai and Sons.
6. Let us C – Yeshwant Kanitkar
7. The 8051 Microcontroller – K.J. Ayala (Penram International)
8. Microcontroller – Theory and Applications – A.V. Deshmuckh , Tata Mcgraw hill
9. The 8051 Microcontroller and Embedded Systems , M. A. Mazadi , J. G. Mazadi, Pearson Education, Asia
10. Programming and customizing the 8051 Microcontroller – Myke Predako (TMH , New Delhi)
11. Fundamentals of Microcontroller and Applications in Embedded Systems – Ramesh Gaonkar Penram Pub.
12. embedded 'C' – M.. J. Pont(Addison Wesley-PEL)
13. 8051 microcontrollers an application based introduction—David Calcutt, Fred Cowan, Hasan Parchizadeh (Elsevier)

B.Sc. III Electronics

Paper VIII

Power Electronics and Industrial Electronics

Section-I

1. Silicon controlled rectifier **8**

SCR, Construction, working, Characteristics and Ratings.
Triggering Circuits:_ SCR Turn ON and Turn OFF.
Turn ON using R, RC and UJT. Turn OFF (Natural and forced).
Commutation methods (Class A, Class B, and Class C).
Protection circuits, SCR dv/dt and di/dt calculations, Series and Parallel connections of SCR, Thermal considerations and Heat Sink.

2. Thyristors, Power Diode and Power Transistors **8**

Diac, Triac, PUT and GTO (Construction, working and characteristics)
Reverse recovery characteristics of power diode and its ratings.
Effect of reverse and forward Recovery time, Series and Parallel connections.
Power Transistors:- BJT, MOSFET and IGBT.
(construction and switching characteristics)

3. Controlled Rectifiers **8**

Phase control, Single phase half wave controlled rectifier with resistive load,
Single phase full wave controlled rectifier with resistive and inductive load.
Effect of free wheeling diode.
Three phase full wave controlled Rectifier with resistive load.

4. Invertors **6**

Classification of inverters, Principle and working of series and parallel invertors, Mc-Murray Bedford inverter (without mathematical treatment)

5. Choppers **6**

Basic chopper circuit, SCR Choppers: Step down and step up chopper, Chopper configuration and characteristics, Jones Chopper

6. Applications **6**

Solid state Relay.
Uninterrupted power supply, switched mode power supply
(Operating principle, Block schematic, Working, Uses and Limitation)

Section II

7. Design Process of PCB **8**

Design Criterion of PCB, material used, Single Side and Double Side PCB,
General design guidelines for PCB. Design guidelines for analog and digital circuit PCB.
PCB Manufacturing process.
Iron soldering and Wave Soldering technique. Introduction to SMD technology.

8. Speed Control of Motors **8**

DC Motor (working principle), speed Relation, Speed-Torque Characteristic
(Constant torque /Constant power).
DC Motor Control for series and shunt by using SCR.
AC Motor (Low torque):- Speed regulation by armature current control of series AC
Motor Stepper Motor (working principle),
Stepper Motor control circuit.

9. R.F Heating **6**

Induction Heating:- Principle, Theory, Merits and demerits, Applications.
Class-C power amplifier for High frequency.
Dielectric Heating:- Principle, Theory, Merits and demerits, Applications.

10. Industrial Circuits **10**

D.C and a.c Timer using SCR, UJT long duration timer, Triac as static switch,
Fan speed regulator, Light Dimmer, AC Voltage stabilizer (Relay, Servo)
Ultra Sonic generator (Magneto-striction)

11. Control Systems **8**

Basic control system, Open loop and Closed loop systems and their Transfer Functions, Comparison of both.
Servo Mechanism (Actuators). (Working principle, characteristics, limitation)
Discontinuous and continuous control systems:- ON- OFF Control System,
Proportional, PI, PID control systems. Introduction to PLC (Allen Bradley)

Reference Books

1. Power Electronics-M.H.Rashid (PHI)
2. Power Electronics-Dr. P L. S. Bimbra, (Khanna Pub.)
3. Power Electronics-P.C.Sen
4. Thyristor Engineering-M. S. Berde, (Khanna publications).
5. Power Electronics principles and Applications-S. Biswas (Dhanapat Rai publications)
6. Industrial and Power Electronics-Harish C Rai-Umesh publicatioin.
7. Electronics Drafting & PCB Design-James & M-Kirlepatrik Galgotia publication.
8. Printed Circuit board (design and Technology), Bosshart Wlter C (TMH).
9. Industrial Electronics & Control-S K Bhattacharya & S. Chatterjee (TMH).
10. Control-System Engineering –Nagrath & Gopal, (New Age publication)
11. Automatic Control System by B.C.KUO, (PHI)
12. Automatic Control System – Bakshi (Technical).

List of Practicals

Group A

1. Study of Op-AMP parameters.
2. Op-AMP as Adder and Subtractor.
3. Op-AMP as Integrator and Differentiator.
4. Op-AMP as Voltmeter and Ammeter.
5. Op-AMP as Band pass / Band stop filter.
6. Wien Bridge / Phase Shift Oscillator using Op-AMP.
7. Schmitt Trigger using Op-AMP.
8. Astable / Monostable Multivibrator using Op-AMP.
9. PLL Characteristics / Application as Frequency multiplier.
10. Function Generator (8038)

Group B

1. Characteristics of thermal transducers (Thermistor and RTD).
2. Study of thermocouple (with compensating amplifier).
3. ON-OFF temperature controller (LM 34 / LM35 / AD 590).
4. Instrumentation Amplifier (LM 324 / TL 084).
5. Study of LVDT.
6. Study of Strain gauge (Load cell).
7. Voltage measurement by using IC 7107.
8. PH measurement.
9. ECG amplifier / Measurement of heart beats.
10. Speed measurement by Optical transducer / Single channel DAS.

Group C

1. Addressing modes / Arithmetic operations using 8085.(simple programs).
2. Arithmetic / Logical operations using 8051. (Bit and Byte level).
3. Square wave generator using timer of 8051 microcontroller.
4. Speed control of DC / Stepper motor using 8051 microcontroller.
5. Interfacing 7 segment LED / LCD display with 8051.
6. Interfacing ADC / DAC with 8051.
7. Descending and ascending array programming in C.
8. Logical and Bit processing with Embedded C
9. Running LED using Embedded C.
10. Serial Communication using Embedded C.
11. Simulation software program using Kiel microversion-3 (a simple example).

Group D

1. SCR firing by UJT.
2. Characteristics of MOSFET / IGBT.
3. Full-wave controlled rectifier.
4. SCR Chopper
5. DC to DC Converter.
6. AC and DC timer.
7. Speed control of DC motor (using PWM).
8. Light dimmer using Triac
9. Design of voltage regulator using LM317.
10. SMPS (TL 494/3524)

Note: Minimum 80% experiments from each group should be performed.

List of Demonstration Experiments

1. PC Assembling.
2. Microcontroller kit study & Traffic Light control.
3. Robotic Arm controlled by microcontroller/ microprocessor.
4. Proximity Switch for object counting.
5. Lux meter and its calibration.
6. Microprocessor kit study & Rolling Display.
7. Digital frequency counter.
8. Uninterrupted power supply (UPS).
9. Emergency Light.
10. PID Controller.
11. Design of electronic circuit with Mat lab.
12. Inverter.
13. Study of energy meter.
14. Digital Balance.
15. Humidity measurement.
16. Digital Room Thermometer.
17. Serial Communication using Microcontroller
18. Miscellaneous experiment 1.
19. Miscellaneous experiment 2.
20. Miscellaneous experiment 3

Note: Minimum **five** Demo experiments should be performed by the students.