

University of Pune

**Three Year B. Sc. Degree Course in
Electronic Science**

1) Title of the Course : B. Sc. Electronic Science

F.Y.B.Sc. Electronic Science Syllabus

(To be implemented from Academic Year 2013-14)

2) Preamble:

The systematic and planned curricula from first year to the third year shall motivate and encourage the students for pursuing higher studies in Electronics and for becoming an enterprenur.

3) Introduction:

At **first year of under-graduation**The basic topics related to the fundamentals of electronicsare covered. Since electronics is very close to technological advancements, the practical course is intended to achieve the basic skills required for circuit building and testing.

At **second year under-graduation**: The level of the theory and practical courses shall be one step ahead of the first year B.Sc. Courses based on content of first yearshall be introduced. Analog and digital circuit design concepts will be introduced at this stage.

At **third year under-graduation**:Theory papers in each semester deal with the further detailed studies of the branches of Electronics. The first two practical courses shall be based on the theory courses. Third practical course is project course in which student can independently think and carry out the project work.

Objectives:

- To provide indepthknowledge of scientific and technological aspects of electronics
- To familiarize withcurrent and recent technological developments
- To enrich knowledge through programmessuch asindustrial visits, hobby projects, market survey, projects etc.
- To train students in skills related to electronics industry and market.
- To creat foundation for research and development in Electronics
- To develop analytical abilities towards real world problems
- To help students build-up a progressive and successful career in Electronics

4) Eligibility:

- 1 **First Year B.Sc.:**Higher Secondary School Certificate (10+2) Science stream or its equivalent Examinationas per the University of Pune eligibility norms.
- 2 **Second Year B.Sc.:** Keeping terms of First Year of B. Sc. with Electronic Science as one of the subjects. Other sudents if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.

- 3 **Third Year B. Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with Electronic Science as one of the subjects.

Note: Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with conditions laid down by the University of Pune. Reservation and relaxation will be as per the Government rules.

5 A) Examination Pattern:

First Year B. Sc. Electronic Science

Pattern of Examination: Annual

Theory courses (EL-101): Annual (EL-102): Annual

Practical Course (EL-103): Annual

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of 20	External marks out of 80	Total marks out of 100
Theory Paper I (EL-101) (First term)	Principles of Analog Electronics	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper I (EL-101) (Second term)	Principles of Analog Electronics	Three lectures/Week (Total 36 lectures per term)			
Theory Paper II (EL-102) (First term)	Principles of Digital Electronics	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper II (EL-102) (Second term)	Principles of Digital Electronics	Three lectures/Week (Total 36 lectures per term)			
Practical Paper III (EL-103) (First & Second Term)	Practical	10 Practicals of 4 lectures in each term (20 practicals / year)	08	32	40 *

* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks

3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on internal assessment tests + journals + attendance + study visit reports/ market survey/hobby projects etc.

Theory examination will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2, 3 and 4	4 out of 6– short answer type questions; answerable in 8 – 10 lines
Question 5	4 out of 6 – problem type question; answerable in numerical or analytical fashion or circuit/logic diagrams

Internal examination: Internal assessment of the student by respective teacher will be based on written test, 10 marks each term. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain). There shall be 20 questions.

Practical: one internal assessment test + marks for journals + attendance + activity.

Practical Examination: Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of 6 hours duration (2-Sessions). Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

Second Year B. Sc. Electronic Science

Pattern of examination: Semester

Theory courses (Sem I: EL211 and EL212): Semester

(Sem II: EL221 and EL222): Semester

Practical Course (EL223): Annual

Paper/ Course No.	Title	Total Number of lectures/practicals Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
Theory Paper I (EL 211)	Paper I	Four lectures/Week (Total 48 per Semester)	04	16	20 *

Theory Paper II (EL 212)	Paper II	Four lectures/Week (Total 48 per Semester)	04	16	20 *
Theory Paper I (EL 221)	Paper I	Four lectures/Week (Total 48 per Semester)	04	16	20 *
Theory Paper II (EL 222)	Paper II	Four lectures/Week (Total 48 per Semester)	04	16	20 *
Practical paper III (EL 223) (First & Second Semester)	Paper III	12 Practicals of 4 lectures in each Semester (24 practicals / year)	08	32	40 **

* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

** Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 + 50) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on internal assessment tests + journals + attendance + study visit reports/ market survey/hobby projects etc.

Theory examination will be of two hours duration for each theory course. There shall be 4 questions each carrying marks as per the table. The pattern of question papers shall be:

Question 1	4 sub-questions, each of 1 marks and 4 sub-questions, each of 2 marks on entire syllabus	12 marks
Question 2 and 3	2 out of 3 sub-questions, each of 4 marks; short answer type questions; answerable in 8–10 lines	8 marks each
Question 4	2 out of 3 sub-questions, each of 6 marks; long answer type questions (12-16 lines), problems, circuit/logic diagrams and designs	12 marks

Internal examination: Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: one internal assessment test + practical journal + attendance + activity

Practical Examination: Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 6 hours (2-Sessions) duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

Third Year B. Sc. Electronic Science

Pattern of examination: Semester

Theory courses:

(Sem III: EL331-EL336): Semester (Sem IV: EL341-EL346): Semester

Practical Course:

(EL347-EL349): Annual

Theory Papers					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
SEM III					
EL-331	Paper I	48	4	16	20*
EL-332	Paper II	48	4	16	20*
EL-333	Paper III	48	4	16	20*
EL-334	Paper IV	48	4	16	20*
EL-335	Paper V	48	4	16	20*
EL-336	Paper VI	48	4	16	20*
SEM IV					
EL-341	Paper I	48	4	16	20*
EL-342	Paper II	48	4	16	20*
EL-343	Paper III	48	4	16	20*
EL-344	Paper IV	48	4	16	20*
EL-345	Paper V	48	4	16	20*
EL-346	Paper VI	48	4	16	20*
Practical Papers					
EL 347 (Semester III & IV)	Practical Paper I	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
EL 348 (Semester III & IV)	Practical Paper II	12 Practicals of 4 lectures in each	08	32	40 **

		Semester (24 / year)			
EL 349 (Semester III & IV)	Project Practical Paper III	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **

* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

** Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50×6) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers given on the basis of internal assessment tests and for practicals on internal assessment tests + journals + attendance + study visit reports/ market survey/hobby projects etc.

Theory examination will be of two hours duration for each theory course. There shall be 4 questions each carrying marks as per the table. The pattern of question papers shall be:

Question 1	4 sub-questions, each of 1 marks and 4 sub-questions, each of 2 marks; on entire syllabus	12 marks
Question 2 and 3	2 out of 3 sub-questions, each of 4 marks; short answer type questions; answerable in 8–10 lines	8 marks each
Question 4	2 out of 3 sub-questions, each of 6 marks; long answer type questions (12-16 lines), problems, circuit/logic diagrams and designs	12 marks

Internal examination: Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question (Describe/Explain) There shall be 20 questions.

Practicals: one internal assessment test + practical journals + attendance + activity.

Practical Examination: Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of 6 hours (2-Sessions) duration. Certified journal is compulsory to appear for practical examination. There shall be one expert and two examiners per batch for the practical examination. One of the examiners will be external.

5 B) Standard of Passing:

- i. In order to pass in the first year theory examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Theory Examination.)

- ii. In order to pass in the Second Year and Third Year theory examination, the candidate has to obtain 20 marks out of 50 in each course of each semester. (Minimum 16 marks out of 40 must be obtained in the University Theory Examination.)
- iii. In order to pass in practical examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Examination.)

5 C) ATKT Rules:

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 12) should be passed; however all F.Y.B.Sc. courses should be passed while going to T.Y.B.Sc. While going from S.Y.B.Sc. to T.Y.B.Sc., at least 12 courses (out of 20) should be passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

5 D) Award of Class:

The class will be awarded to the student on the aggregate marks obtained during the second and third year in the principal subject only. The award of the class shall be as follows:

1	Aggregate 70% and above	First Class with Distinction
2	Aggregate 60% and more but less than 70%	First Class
3	Aggregate 55% and more but less than 60%	Higher Second Class
4	Aggregate 50% and more but less than 55%	Second Class
5	Aggregate 40% and more but less than 50%	Pass Class
6	Below 40%	Fail

5 E) External Students: There shall be no external students.

5 F) Setting question papers:

F.Y.B.Sc.: For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III, papers shall be set by the University of Pune and assessment done at the respective colleges.

S.Y.B.Sc. and T.Y.B.Sc.: For theory papers I and II for each semester and also for the annual practical examination question papers set by the University of Pune. Centralized assessment for theory papers done as per the University instructions. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Papers, papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.

5G) Verification and Revaluation Rules:

As per university Statues and rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

6) Course Structure:

Duration: The duration of B.Sc. Electronic Science Degree Program shall be three years.

a) Compulsory Papers:

F.Y.B.Sc. : 2 Theory + 1 Practical (Annual)

S .Y.B.Sc.: 2 Theory per semester + 1 Practical (Annual)

T.Y.B.Sc.: 5 Theory per semester + 3 Practical (Annual)

b) Optional Papers:

One theory out of two optional papers per semester for third year only

c) Question Papers :**F.Y.B.Sc.Theory paper:**

University Examination – 80 marks (at the end of 2nd term)

Internal Examination – 20 marks

S.Y / T.Y. - B.Sc.Theory paper:

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

F.Y. / S.Y / T.Y. - B.Sc.Practical Paper:

University Examination – 80 marks (at the end of 2nd term)

Internal Examination – 20 marks

d) Medium of Instruction: The medium of instruction for the course shall be English.**7) Equivalence of Previous Syllabus:**

Old Course (2008 Pattern)	New Course (2013 Pattern)
Paper I: Principles of Analog Electronics	EL-101: Principles of Analog Electronics
Paper II: Principles of Digital Electronics	EL-102: Principles of Digital Electronics
PaperIII: Practical	EL-103: Practical

8) University Terms: Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

9) Qualification of Teachers:M.Sc. Electronic Science or equivalent master degree in science with class/grades and NET/SET as per prevailing University/Government /UGC rules.

10) Detail Syllabus with Recommended Books:**F.Y. B. Sc. Electronic Science****Paper I****EL-101: Principles of Analog Electronics****Objectives:**

1. To get familiar with basic circuit elements and passive components
2. To understand DC circuit theorems and their use in circuit analysis
3. To study characteristic features of semiconductor devices
4. To study elementary electronic circuits and applications
5. To understand basics of operational amplifiers.

Term I**Unit 1: Passive Components (12)**

Study of basic circuit elements and passive components (with special reference to working principle, circuit symbols, types, specifications and applications): Resistor, Capacitor, Inductor, Transformer, Cables, Connectors, Switches, Fuses, Relays, Batteries.

Unit 2: Basic Electrical Circuits and Circuit Theorems (14)

Concept of Ideal Voltage and Current source, internal resistance, dc sources (voltage/current) and sinusoidal ac source (amplitude, wavelength, period, frequency, phase angle), Network terminology, Ohms law, series and parallel circuits of resistors, capacitors and inductors, voltage and current dividers, Kirchhoff's Laws (KCL, KVL), Superposition theorem, concept of black box, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem (numerical problems with maximum two meshes), Charging-discharging of capacitor, AC applied to R, C and L, concept of impedance, LCR series resonant circuit, concept of phase difference, RC low pass and high pass filter

Unit 3: Semiconductor Diodes and Circuits (10)

Study of semiconductor devices with reference to symbol, working principle, I-V characteristics, parameters, specifications: diode, zener diode, light emitting diode, photo diode, optocoupler, varactor diode, solar cell, clipper and clamper circuits Rectifiers (half and full wave), rectifier with capacitor-filter, Zener regulator, Block diagram of power supply

Term II**Unit 4: Bipolar Junction Transistor and Circuits (14)**

Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, I-V characteristics, parameters, specifications. Concept of amplification, voltage and current amplifier. Transistor amplifier configurations - CB, CC and CE, biasing circuits - voltage divider, collector feedback bias and emitter feedback bias, DC load line (CE), Q point and factors affecting the stability, transistor as a switch, concept of

class A, B and class C amplifiers, emitter follower amplifier, Single stage RC coupled CE amplifier, concept of frequency response and bandwidth

Unit-5:UJT,FETs and Applications (10)

Symbol, types, construction, working principle, I-V characteristics, Specifications parameters of:Uni-Junction Transistor (UJT),Junction Field Effect Transistor (JFET), Metal Oxide Semiconductor FET (MOSFET), comparison of JFET, MOSFET and BJT

Applications: JFET as voltage variable resistor, MOSFET as a switch

Unit 6: Operational Amplifier (12)

Symbol, block diagram, Opamp characteristics, basic parameters (ideal and practical) such as input and output impedance, bandwidth, differential and common mode gain, CMRR, slew rate, Concept of virtual ground, concept of feedback, Information about IC741

Opamp as inverting and non-inverting amplifier, voltage follower, adder, subtractor
Opamp as a comparator and Schmitt trigger

Text/ Reference Books:

1. Basic Electronics:Bernard Grob, McGraw Hill Publication, 8th Revised Edition, 2010
2. Electronic Principles:Albert Malvino, David J Bates, McGraw Hill 7th Edition. 2012
3. Principles of Electronics: V.K. Mehta, S.Chand and Co.
4. A text book of electrical technology: B.L.Theraja, S.Chand and Co.
5. Basic Electronics and Linear Circuits: Bhargava N.N., Kulshreshtha D.C., Gupta S.C., Tata McGraw Hill.
6. A First Course in Electronics: Khan Anwar, K.K.Day, PHI learning Pvt.Ltd.
7. Electronic Devices and Circuits: Bolyestad, Tata McGraw Hill.
8. Electronic Devices and circuits: A. Motorshed, Prentice Hall of India.
9. Basic Electronic Devices and Circuits: R.Y.Borse, 1stEdition 2012, Adhyayan Publishers and Distributors, New Delhi.

Paper II

EL-102: Principles of Digital Electronics

Objectives:

1. To get familiar with concepts of digital electronics
2. To learn number systems and their representation
3. To understand basic logic gates, boolean algebra and k-maps
4. To study arithmetic circuits, combinational circuits and sequential circuits
5. To study comparative aspects of logic families.

Term I

Unit 1: Number Systems and Logic Gates (12)

Introduction to decimal, Binary and hexadecimal number systems and their inter-conversions,Signed and fractional binary number representations, BCD, Excess-3 and Graycodes, Alphanumeric representation in ASCII codes.

Positive and Negative Logic, Basic Logic gates (NOT, OR, AND) & derived gates (NAND, NOR, EX-OR) Symbol and truth table, Applications of Ex-OR gates as parity checker and generator.

Unit 2: Boolean Algebra and Karnaughmaps (12)

Boolean algebra rules and Boolean laws: Commutative, Associative, Distributive, AND, OR and Inversion laws, DeMorgan's theorem, Universal gates. Min terms, Max terms, Boolean expression in SOP and POS form, conversion of SOP/POS expression to its standard SOP/POS form., Simplifications of Logic equations using Boolean algebra rules and Karnaugh map (up to 3 variables).

Unit 3: Arithmetic Circuits (12)

Rules of binary addition and subtraction, subtraction using 1's and 2's complements, half adder, full adder, Half subtractor, Full subtractor, Four bit parallel adder, Universal adder / subtractor, Digital comparator, Introduction to ALU.

Term II

Unit 4: Combinational Circuits (14)

Multiplexer (2:1, 4:1), demultiplexer (1:2, 1:4) and their applications, Code converters - Decimal to binary, Hexadecimal to binary, BCD to decimal, Encoder & decoder 3x4 matrix keyboard encoder, priority encoder, BCD to seven segment decoder.

Unit 5: Sequential Circuits (14)

Flip flops :RS using NAND/NOR, latch, clocked RS, JK, Master slave JK, D and T. **Counters**: Ripple Binary counter, up down counter, concept of modulus counters, Decade counter, Counters for high-speed applications (Synchronous counters) with timing diagrams.

Shift registers: SISO, SIPO, PISO, PIPO shift registers, ring counter, universal 4-bit shift register and Applications.

Unit 6: Logic Families (8)

Introduction to Integrated circuit technologies TTL, ECL, CMOS
IC parameters: Logic levels, switching speed, propagation delay, power dissipation, noise margins and fanout of TTL and CMOS.
TTL NAND & NOT gate, Open collector gates, Wired OR operation. CMOS - NOT, NAND, NOR gate, precautions while handling CMOS gates, tri-state logic.

Text/ Reference Books:

1. Digital Electronics: Jain R.P., Tata McGraw Hill
2. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
3. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education

Paper III

EL-103: Practical Course

- 1 The practical course consists of 20 experiments.
- 2 Any two of the following activities with proper documentation will be considered as equivalent of 4 experiments weightage in term work.
 - i. Preparatory experiments
 - ii. Hobby projects
 - iii. Internet browsing
 - iv. industrial visit / live work experience
 - v. PCB Making
 - vi. Market Survey of Electronic Systems
 - vii. Circuit Simulations and CAD tools
 - viii. Study Tour and its report writing

These will be evaluated in an oral examination for 20% marks at internal and term end examination.

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

Group A Any Four

1. Study of forward and Reverse biased characteristics of PN Junction Diode
2. Study of breakdown characteristics and voltage regulation action of Zener diode
3. Study of output characteristics of Bipolar Junction Transistor in CE mode
4. Study of output and transfer characteristics JFET/MOSFET
5. Study of I-V characteristics of UJT and Demonstration of UJT based relaxation oscillator .
6. Study of solar cell.

Group B Any four

1. Verification of network theorems: KCL / KVL, Thevenin, Norton.
2. Verification of network theorems: Maximum Power Transfer, Superposition theorem.
3. Design, build and test Low pass and High pass RC filters.
4. Study of low voltage Half-wave, Full-wave and Bridge rectifier circuits.
5. Study of amplification action of BJT.
6. Study of potential divider biasing of BJT and its use in DC motor driving.
7. Build and test Inverting and non inverting amplifier using OPAMP.
8. Build and test adder and subtractor circuits using OPAMP.
9. Study of clipping and clamping circuits.

Group C Any Four

* Minimum Two experiments may be carriedout with CMOS ICs

1. Basic Logic gates using Diodes and transistors
2. Interconversions and realizations of logic expressions using ICs
3. Study of RS, JK and D flip flops using NAND gates
4. Study of Up/Down Counter

5. Study of decade counter IC circuit configurations
6. Study of 4-bit Shift register IC

Group D Any Four

1. Build and Test 4 bit parity checker/ generator using X-OR gate IC
2. Build and Test Half Adder, Full Adder and Subtractor using basic gate
3. Build and Test 2:1 Multiplexer and 1:2 Demultiplexer using gates
4. Build and Test 3X4 matrix Keyboard Encoder
5. Build and Test a Debounce switch using NAND or NOR gate IC
6. Build and Test Diode matrix ROM
7. Study of Four bit Universal Adder/Subtractor / ALU

Preparatory Experiments

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 Multimeters (Analog and Digital)
 - Measurement of AC/DC voltage and Current – on different ranges
 - Measurement of R & C
 - Testing of Diodes & Transistors
 - Measurement of h_{fe}
 - Use of Multimeter in measurement of Variation of Resistance of LDR.
 - Thermister
3. Study of Signal Generator/CRO
 - Understand how to use Signal Generator/CRO
 - Study of front panel controls
 - Measurement of amplitude and frequency of Sine/Square waveform
 - Measurement of Phase with the help of RC circuit
 - Demonstration of Lissajous figures
 - Demonstrate the use of Component testing facility

Hobby Project Examples

Build and Test gadgets like

- Water level Indicator
 - Photo relay / smoke detector
 - Burglar Alarm
 - Fan regulator
 - Logic Probe
 - Experiments with some software's like PSPICE / LTSPICE
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