B. SC. ELECTRONICS
SYLLABUS

B. SC. - I

The examination shall consist of three theory papers and a practical examination. The marks allotted to each shall be as follows.

Paper	Subject	Max. Marks
Paper I	Circuit Elements and Network Analysis	45
Paper II	Coupled Circuits and Measuring Instruments	45
Paper III	Physical Electronics	45
Practical Examination		65
	Total :	200

PAPER I : CIRCUIT ELEMENTS AND NETWORK ANALYSIS

(a) Passive Circuit Elements : Ideal resistors, capacitors and inductors and their characteristics; Dielectric, eddy current and hysteresis losses, skin effect; Practical circuit elements, their equivalent circuits and behavior at low and high frequencies; Measurement of resistance, capacitance and inductance using AC. Source; Design consideration of circuit elements.

(b) Transient Analysis and AC. Circuits : LCR circuit connected to D.C. source and its application; Vector impedance and admittance; Phase angle and power factor; Series and parallel LCR circuits, their electrical impedance and admittance; Half power points and Q of the circuit; Idea of polyphase circuit.

(c) Network Analysis : Different types of circuit elements; Network definitions; Generalized Kirchoff's laws; Mesh equations and matrix elements; T and π network and their equivalence; The bridged T-network, symmetrical network.

(d) Network Theorems : Theorem for the reduction of a passive network into T and π network; Superposition; Reciprocity; Norton and Maximum power transfer theorems and their applications.

Books Recommended :
1. Electricity and Electronics by H.B. Lal & R.B. Singh (United Book Depot, Allahabad.
2. Foundation of Electronics by D. Chattopadhyaya & P.C. Rakshit (Neew Age International, New Delhi)
3. Network Lines & Field by J.D. Ryder (PHI Pvt. Ltd., New Delhi)

PAPER II : COUPLED CIRCUITS AND MEASURING INSTRUMENTS

(a) Filter : Input and transfer impedances; Symmetrical T and π networks and their characteristic impedances and propagation constant; Basic theory of filters; Different kind of filters, their pass and attenuation bands and characteristic impedances; Constant k, m-desired and matching L - section filters and their

analysis; Design of low and high pass filter sections (constant k, m-desired and matching L -sections).

(b) Attenuators : Attenuator and its purpose, Types of attenuator; Fixed attenuator; L, T and π pads; Variable attenuator; Symmetrical bridged T attenuator; Lattice type attenuator; Ladder attenuator.

(c) Coupled Circuits : Basic features of magnetically coupled circuits, leakage flux and leakage inductances; Equivalent T network of magnetically coupled circuits; Design consideration.

(d) Transformer : Transformer and their classification; Ideal transformer; Audio transformer, Output and input transformer and their phase and frequency response; Radio frequency transformer; Single and double tuned; Selectivity consideration and general analysis of doubly tuned RF transformers; Overcoupling; Design consideration of AF and RF transformers.

(e) Measuring Instruments : Introductory idea of measuring instruments; AC. Ammeter, Voltmeter, VTVM, Multimeter and CRO; Testing of circuit elements using multimeter and CRO.

Books Recommended :
1. Electricity and Electronics by H.B. Lal & R.B. Singh (United Book Depot, Allahabad.
2. Network Lines & Field by J.D. Ryder (PHI Pvt. Ltd., New Delhi)
3. Electronic Instrumentation & Measuring Techniques by W.D. Cooper (PHI Pvt. Ltd., New Delhi)

PAPER III : PHYSICAL ELECTRONICS

(a) Electronic Emission and Tubes : Potential energy of electrons in metals, work function, thermionic emission; Space charge; Physics of vacuum tubes; Effect of gas in tubes; Glow tubes and ignition.

(b) Semiconductor Physics : Elementary idea of energy bands; Difference between semiconductors, metals and insulators; Intrinsic and extrinsic semiconductors, Minority and majority charge carriers; Drift and diffusion currents; Recombination and generation; Continuity equations.

(c) Junction : Metal-metal junction, and contact potential; Metal-semiconductor junction; P-N junction; Barrier formation; Barrier potential; Width and capacitance of depletion region; Current flow in biased p-n junction; Junction breakdown; Zener and avalanche phenomenon; Zener and Varactor diodes, Photo diode; LED and solar cell.

(d) Transistor : BJT, n-p-n and p-n-p transistors; Transistor operation and Ebber-Moll model; Current flow in transistor; Characteristics in all three configurations; A, B and hybrid parameters; Structure, operation, characteristics and parameters; FET and MOSFET; Photo transistors; SCR and UJT.

Books Recommended :
1. Electricity and Electronics by H.B. Lal & R.B. Singh (United Book Depot, Allahabad.
2. Transistor by D.L. Croissette (PHI Pvt. Ltd., New Delhi)
3. Electronic Fundamental & Application by D. Chattopadhyaya (New Age International, New Delhi)

(A)   LIST OF EXPERIMENTS

1.   Measurement of resistance, capacitance and inductance using LCR bridge.
2.   Study of the behavior of LCR circuits at different signal frequencies.
3.   Static characteristics of p-n junction.
4.   Static characteristics of Zener diode.
5.   Verification of Network theorems.
6.   Static characteristics of Varactor diode.
7.   Characteristics of Light Emitting Diode (LED).
8.   Static characteristics of p-n-p transistor in CE configuration.
9.   Static characteristics of p-n-p transistor in CB configuration.
10. Static characteristics and parameters of FET.
11. Determination of energy band gap in semiconductor.
12. Determination of Q of RF coil.
13. Measurement of incremental inductance using AC. bridge.
14. Static characteristics of Beam Power Tube.
15. Characteristics of Photo Diode.
16. Characteristics of Solar Cell.
17. Study of Thermistor.

A record book has to be maintained by the examinees of the practicals done in the class and duly checked by the teacher.

(B)   ELECTRONIC WORKSHOP- I

1.   Familiarity with construction, values and rating of passive circuit elements; resistor, inductor, capacitor and transformer spot work.
2.   Familiarity with multimeter and testing of passive circuit elements.
3.   Knowledge and practice of fabricating inductor and transformer.

A workshop record book duly signed by the teacher has to be maintained by the examinee of the workshop practice done in the class.

PRACTICAL EXAMINATION

Total duration of examination shall be of four hours and the candidates will be required to perform one experiment and one workshop test allotted to him. Every candidate will be assigned some work on the spot after he/she finished his/her experiment. Candidate will be required to present his/her work done in electronic workshop at the time of examination alongwith other practical record book. The distribution of marks shall be as following.

Practical Examination	Student appearing as	
	Regular	**Ex**
Experiment	30	30
Viva-voce	12	20
Record	08	--

Electronic workshop test	12	15
Workshop record	03	--
Total :	65	65

B. SC. - II

The examination shall consist of three theory papers and a practical examination. The marks allotted to each shall be as follows.

Paper	Subject	Max. Marks
Paper I	Electronic Circuits I : Regulated Power Supply and Amplifier	45
Paper II	Electronic Circuits II : Power Amplifiers and Oscillators	45
Paper III	Electronic Circuits III : Communication Electronics	45
	Practical Examination	65
	Total :	200

PAPER I : ELECTRONIC CIRCUITS I : REGULATED POWER SUPPLY AND AMPLIFIERS

(A) Regulated Power Supply : Common requirements and sections

(a) Rectifier Circuit : Half, full and bridge rectifier circuits with resistor load, their output waveforms, output DC voltage and power, rectifier efficiency and ripple factor; Design consideration and rating; Voltage multiplying rectifiers; Doubler, trippler and quadrupler.

(b) Filter Circuits : Series inductor, shunt capacitor, L-section, Π -section and R-C filter circuits; Evaluation of output D.C. voltage and ripple factor when they are fed with AC full wave rectifier; Design consideration.

(c) Regulated Circuits : Load and line regulation, stabilization ratio, internal impedance and temperature coefficient of voltage regulation; Linear voltage regulator circuits; Non-feedback type; Series and shunt regulator; Design consideration of each circuit.

(d) Controlled Rectification and Switch Mode Power Supply : SCR controlled half and full wave rectifier circuits and their analysis; Elements of SMPS, SCR control and stability in SMPS.

(B) Amplifier : Basic Requirements and Principles.

(a) Biasing and Stability : General principle of transistor amplifier; Load line and Q point, thermal stability, stability factors; Transistor biasing; Fixed bias, Collector to base bias, emitter bias and voltage divider bias circuits.

(b) Small Signal Transistor Amplifiers : Small signal transistor amplifier circuits in different configurations and Z, Y and hybrid parameters form and their analysis; Noise and distortion in SST amplifier.

(c) Multistage Amplifier : Cascading of amplifier and voltage gain; R-C, L-C and T-C coupled two stage amplifier circuits and their phase and frequency response and bandwidth.

(d) Negative Feedback Amplifier : C-E amplifier with series and shunt feedback; Emitter follower; Source follower, Cascade amplifier for transistor and FET, Darlington pair.

Books Recommended :
1. Electronic Devices and Circuits by J. Millman & C. Halkias (Mc Graw Hill, New York)
2. Electrical Circuits and Introductory Electronics by Vinod Prakash (Lok Bharti Prakashan, Allahabad)
3. Electronic Fundamentals and Applications by J.D. Ryder (PHI Pvt. Ltd., New Delhi)
4. Pulse Digital and Switching Waveforms by J. Millman & H. Taub (Mc Graw Hill, Kogakusha Ltd., New Delhi)

PAPER II : ELECTRONIC CIRCUITS II : POWER AMPLIFIERS AND OSCILLATORS

(a) Power Amplifiers : Untuned power amplifier, Push-pull class A and class B amplifier; Phase inverters; Single and double tuned voltage amplifiers; Tuned class B and class C amplifiers.

(b) Audio Oscillators : Positive feedback and Bark Hausen criteria of sustained oscillation; Phase shift and Wien bridge oscillator.

(c) RF Oscillator : Tuned base, Tuned collector, Hartley and Colpitt oscillator circuit and their analysis; Negative resistance oscillator; Frequency stability; Crystal controlled oscillator; Pierce and Miller circuits.

(d) Microwave Generators : High frequency generation problems; Klystron oscillator; Travelling wave tube generator; Gunn diode microwave generators; Carcinotron, Magnetron and Microwave resonators; MASERS.

(e) Wave Shaping Circuits : Wave shaping using integrating and differentiating circuits; Clipping and Clamping circuits; Blocking oscillators.

Books Recommended :
1. Electronic Devices and Circuits : An Introduction by Allen Mottorshed (PHI Pvt. Ltd., New Delhi)
2. Electronic Devices and Circuits by J. Millman and C. Halkias (Mc Graw Hill, New York)
3. Electronic Fundamentals and Applications by J.D. Ryder (PHI Pvt. Ltd., New Delhi)
4. Electronic Devices and Circuits by G.K. Mithal (Khanna Pub., New Delhi)

PAPER III : ELECTRONIC CIRCUITS III : COMMUNICATION ELECTRONICS

(a) Modulators : Principles of amplitude and angle (phase and frequency) modulations; Amplitude modulation; DSB and SSB systems; Collector modulation circuit and Vander Biji modulations; Angle modulation; BJT and FET reactance modulations; Armstrong phase modulator.

(b) Detectors : Synchronous and envelop AM detectors, FM detector; Balance slope detector; Foster seely discriminator and ratio detector.

(c) Wide Band Amplifier : Wide band voltage amplifier, High and low frequency compensation circuits; Wide band single and double tuned amplifier; Video amplifier for television signal.

(d) Radio Transmitter and Receiver : Qualitative description of amplitude; Frequency modulated and radio telegraph transmitters; General consideration and block diagram description of simple and superheterodyne radio receivers; Automatic volume control and magic eye; Simple radio receiver circuit for standard broadcast; Elements of frequency modulated receiver.

(e) Television : General principle of image transmission, scanning sequence and synchronization; Television camera tubes; Elements of television and receiver circuits; Elements of color television.

(f) Radar : Principle of radar; Elements of radar system and basic radar equations.

Books Recommended :
1. Radio Engineering by G.K. Mithal (Khanna Publication, New Delhi)
2. Electronic Communication System by G. Kennedy (Tata Mc Graw Hill, New Delhi)
3. Principles of Communication System by H. Taub & D.J. Schilling (Tata Mc Graw Hill, New Delhi)
4. Electronic Communication by D. Roddy & J. Coolen ((PHI Pvt. Ltd., New Delhi)

(A) LIST OF EXPERIMENTS

1. Study of half wave rectifier.
2. Study of full wave and bridge rectifier.
3. Study of unregulated power supply.
4. Study of Zener and emitter follower regulator circuits.
5. Study of transistor series and shunt regulator circuits.
6. Study of controlled rectification using SCR.
7. To study biasing stability in BJT.
8. Phase and frequency response of RC network.
9. Phase and frequency response of low pass and high pass filter.
10. Phase and frequency response of interstage transformer.
11. Phase and frequency response of R-C coupled amplifier.
12. Generation and Fourier analysis of saw tooth wave.
13. Design and Fourier analysis of multivibrator wave.
14. Study of amplitude modulation.
15. Study of linear detector.
16. Study of radio receiver.
17. Study of television receiver.

A record book has to be maintained by the examinees of the practicals done in the class and duly checked by the teacher.

(B) ELECTRONIC WORKSHOP PRACTICE- II

1. Testing of electronic component by CRO and their measurement by LCR bridge.
2. Design of regulated low voltage power supply.
3. Design of low signal R-C coupled amplifier.
4. Basic knowledge of the circuits of the test instruments.
5. Identification of electronic components.

A workshop record book duly signed by the teacher has to be maintained by the examinee of the workshop practice done in the class.

PRACTICAL EXAMINATION

Total duration of examination shall be of four hours. Every candidates will be required to perform one experiment allotted to them from Group A and one workshop test based on details given in B on the spot after finishing the experiment. Candidates will be required to present their work done in electronic workshop at the time of examination alongwith other practical record book. The distribution of marks shall be as follows.

Practical Examination	Student appearing as	
	Regular	**Ex**
Experiment	30	30
Viva-voce	12	20
Record	08	--
Electronic workshop test	12	15
Workshop record	03	--
Total :	65	65

B. SC. - III

The examination shall consist of four theory papers, a practical examination and a project work. The marks allotted to each shall be as follows.

Paper	Subject	Max. Marks
Paper I	Propagation of Electromagnetic Waves and Antenna	50
Paper II	Linear Integrated Circuits	50
Paper III	Digital Electronics	50
Paper IV	Introduction to Microprocessors	50
	Practical Examination	70
	Project Work	30
	Total :	300

PAPER I : PROPAGATION OF ELECTROMAGNETIC WAVES AND ANTENNA

(a) Electromagnetic Waves : Maxwell's electromagnetic field equations; Poynting theorem; Electromagnetic wave and its propagation in free dielectric media.

(b) Transmission Lines : Current voltage relation; Transmission lines constants; Impedance and power factors; Smith chart; Matching and direction couplers; Co-axial lines.

(c) Wave Guide : General consideration; Rectangular wave guide; Mode of propagation; TE, TM and TEM modes; Impedance matching; Directional and cavity resonators.

(d) Free Space Propagation : Ground waves; Space waves; Space waves through troposphere, ionosphere and sky wave propagation; Skip distance and maximum usable frequency; Signal strength; Effect of earth magnetic field; Satellite communication.

(e) Antenna : Current and voltage distribution in antenna; Distribution of field around a short electric dipole; Radiation resistance; Half and full wave antenna; Effective length, effective resistance and efficiency of antenna; Grounded antenna; Matching of antennas; Folded dipole; Antenna arrays; Television antenna.

Books Recommended :
1. A Treatise of Light by R.AHousten (Langmans Green and Sons, London)
2. Electromagnetic waves by S.P. Seth (Dhanpat Rai & Co., Delhi)
3. Networl Lines and Field by J.D. Ryder (PHI Pvt. Ltd., New Delhi)
4. Electromagnetic Waves and Radiating System by E.C. Jordan and K.G. Balmain (PHI Pvt. Ltd., New Delhi)

PAPER II : LINEAR INTEGRATED CIRCUITS

(a) Difference Amplifier : Differential input and common mode input; Common mode rejection ratio; Darlington pair; Cascaded difference amplifier.

(b) Operational Amplifier : Characteristics of operational amplifier; Inverting and non-inverting inputs; Input offset current; Input offset voltage; Slew rate and power bandwidth; Bode plot and frequency response of opamp; Voltage follower; Current follower; opamp integrating and differentiating circuits; opamp audio amplifier; Logarithmic amplifier; Active filters; Operational amplifier for PLL circuits; Opamp voltage controlled oscillator and wave shaping circuits.

(c) Analog Circuit for Computation : Summing amplifier, opamp integrator and differentiator, Solution of simultaneous equations and differential equations using opamp; Time and amplitude scaling.

Books Recommended :
1. Operational Amplifier and Linear Integrated Circuits by R.A. Gayakwad (PHI Pvt. Ltd., New Delhi)
2. Electronic Fundamentals and Applications by J.D. Ryder (PHI Pvt. Ltd., New Delhi)
3. Electronic Fundamentals and Applications by D. Chattopadhyaya and P.C. Rakshit (New Age International, New Delhi)

4. Fundamental of Electronics by E.N. Lurch (John Wiley & Sons, New Delhi)

PAPER III : DIGITAL ELECTRONICS

(a) Number System : Base or radix, Decimal, binary, octal and hexadecimal system, Inter conversion of numbers from one system to the other; Binary addition, subtraction, multiplication and division; BCD and hexadecimal codes; Signed numbers; Ones and two's complement representation and their use in binary addition and subtraction.

(b) Boolean Algebra and Logic Gates : Boolean function; Unary, null, identity and complement functions; Inverse sum, product, sheffer stroke, Pierce arrow, ring plus and ring dot operations; Corresponding logic gates NOT, OR, SUM, NAND, NOR, EX-OR, COINCIDANCE, their symbols and truth tables; Basic postulates and laws of boolean algebra; Indepotance, Absorption one and two, consensus and De-Morgan's theorems; Duality of boolean algebra; Composite boolean function and precedence of operations in algebraic simplification; Universality of NAND and NOR gates.

(c) Combinational Logic Circuits : SOP and minterm, POS and maxterm; Design of logic circuits with multiple outputs; Karnaugh map and Karnaugh simplification; Rebandant group and don't care conditions; Half adder and full adder; Encoder, decoder and BCD to seven segment decoders; Multiplexer and demultiplexer.

(d) Elements of Logic Families : Introduction to different type of gates; RL, DL, RTL, DTL, TTL, ECL and CMOS logic gates, their circuit description and basic characteristics.

(e) Sequential Logic Circuits : Basic sequential circuit; Types of sequential circuits; Synchronous and asynchronous; Flip-flops; RS, JK, and D flip-flops, Master slave flip-flops; Counters; Binary counter, synchronous counter, mod-10 counter, Generation of control signals; Controlled counter; Up-down counter, Shift register, Parity generator or checker, Synchronization of an asynchronous pulse.

(f) Converters : Analog to digital and digital to analog converters.

Books Recommended :
1. Digital Principle and Applications by A.P. Malvino and D.D. Leach (Tata Mc Graw Hill, New Delhi)
2. Digital Electronics : Practice using Integrated Circuits by R.P. Jain and MMS Prasad (Tata Mc Graw Hill, New Delhi)
3. Digital Computer Electronics by A.P. Malvino (Tata Mc Graw Hill, New Delhi)
4. Modern Digital Electronics by R.P. Jain (Tata Mc Graw Hill, New Delhi)

PAPER IV : INTRODUCTION TO MICROPROCESSORS

(a) Introduction and Architecture of Microprocessors : Functional block diagram of a microprocessor and its working, ROM RAM, CPU, Address bus, Data bus and Control bus. Architecture of microprocessor; General registers, Accumulator, Program counter, Stack and Stack pointer, Instruction register and Instruction decoder, Address register, Arithmetic Logic Unit, Control unit.

(b) The 8085 CPU : Functional description, Registers, Interrupts, Serial input and output, Pin description. 8085A timing process, Opcode fetch machine cycle,

Read cycle timing, Write cycle timing, Interrupt acknowledge timing, Bus idle and Halt state, HOLD and HLDA state, SID and SOD signals.

(c) The 8085 Instruction Set and Assembly Language Programming : Data transfer group, Arithmetic group, Branch control group, Stack operation, PUSH, POP, XTHL, SPHL instructions, Input/ Output, Machine control instructions, Straight line programs, Looping program, Some examples of assembly language programming of the processor.

(d) Memory and I/O Addressing : Internal organization of memories, RAM and ROM memory selection and addressing, I/O post addressing by I/O mapped I/O mode and memory mapped I/O mode, Generation of chip select signal. Keyboard interface, Display interface.

(e) Comparison of Microprocessors : Comparative study of the microprocessors; 8085A, Z80 and 6800.

LIST OF EXPERIMENTS

1. Design of multivibrator circuit and Fourier analysis.
2. Characteristics of Horn antenna.
3. Characteristics of FET and MOSFET.
4. Study of FET mixer.
5. Characteristics of radio receivers.
6. Characteristics of a television receiver.
7. Characteristics of operational amplifier.
8. Characteristics of IC logarithmic amplifier.
9. Operational amplifier waveform generators.
10. Study of OR, AND, NOR and NAND gates.
11. Study of Flip-flop circuits.
12. Study of digital display circuits.

PRACTICAL EXAMINATION

Total duration of examination shall be of five hours. The candidates shall be required to perform one experiment and present their Project work in the form of a thesis. The candidate shall have to appear a viva-voce examination for the experiment and the project work. The distribution of marks shall be as follows.

Practical Examination	**Student appearing as**	
	Regular	**Ex**
Experiment	40	40
Viva-voce	18	30
Record	12	12
Project Work	25	25
Project viva-voce	05	05
Total :	100	100