UG SYLLABUS UNDER SEMESTER SYSTEM

ELECTRONICS CORE PROGRAMME

TOTAL CREDITS: 70

DEPARTMENT OF ELECTRONICS
NORTH LAKHIMPUR COLLEGE

(AUTONOMOUS)

P.O. KHELMATI, NORTH LAKHIMPUR, 787 031

B.Sc. Electronics (Core)

Three Year Full-Time Programme (Six Semester Course)

Semester	Course Code	Subject	Marks	L	T	P	C
1	CT-3-ELE-101	Basic physics	60	3	0	0	3
	CP-2-ELE- 102	Lab Course -1	40	0	0	2	2
	Semester Total		100	3	0	2	5
2	CT-3-ELE- 201	Solid State Devices	60	3	0	0	3
	CP-2-ELE- 202	Lab Course -2	40	0	0	2	2
	Semester Total		100	3	0	2	5
3	CT-3-ELE- 301	Analog Electronics-I	60	3	0	0	3
	CT-3-ELE- 302	Quantum Mechanics & Engineering Materials.	60	3	0	0	3
	CP-2-ELE- 303	Lab Course -3	40	0	0	2	2
	Semester Total		160	6	0	2	8
4	CT-3-ELE- 401	Electrical Circuit & Engineering Mathematics	60	2	1	0	3
	CT-4-ELE- 402	Digital Electronics	80	4	0	0	4
	CP-3-ELE- 403	Lab Course -4	60	0	0	3	3
	Semester Total		200	6	1	3	10
5	CT-3-ELE- 501	Network Analysis & Synthesis	60	3	0	0	3
	CT-3-ELE- 502	Electromagnetic Wave propagation & Antenna	60	3	0	0	3
	CT-3-ELE- 503	Analog Communication	60	3	0	0	3
	CT-3-ELE- 504	Instrumentation	60	3	0	0	3
	CT-3-ELE- 505	Digital Communication	60	2	1	0	3
	CP-4-ELE- 506	Lab Course -5	80	0	0	4	4
	PR-2-ELE- 507	Project Phase I	40	0	0	2	2
	Semester Total		420	14	1	6	21

6	CT-3-ELE- 601	Optoelectronics	60	2	1	0	3
	CT-3-ELE- 602	Microprocessor &Microcontroller	60	3	0	0	3
	CT-3-ELE- 603	Analog Electronics-II	60	3	0	0	3
	CT-3-ELE- 604 A	Power Electronics (Optional)	60	3	0	0	3
	CT-3-ELE- 604 B	Consumer Electronics (Optional)					
	CT-3-ELE- 605	Introduction to Computer & Programming	60	3	0	0	3
	CP-3-ELE- 606	Lab Course -6	60	0	0	3	3
	PR -3-ELE- 607	Project Phase II	60	0	0	3	3
	Semester Total		420	14	1	6	21
Programme Total			**1400**	**46**	**3**	**21**	**70**

L – LECTURES PER WEEK (1 hour)

T- TUTORIALS PER WEEK (1 hour)

P – PRACTICALS PER WEEK (2 hours)

C – CREDITS

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE-101	Basic physics	60	3	0	0	3

PAPER - CT-3-ELE- 101 Total Class = 64
Total Marks = 60
Basic physics

Unit-I (Marks=12)
Crystal structure and bonding: Crystalline and Non-crystalline solids, Crystal Lattice, Unit Cell, Miller Indices and Miller Planes, Principle of X-ray diffraction.

Classical free electron theory, electrical and thermal conductivity of metals, Relaxation time and mean free path, qualitative discussion of the Bloch function, Kronig-Penny model, E-k diagram, reduced zone representation, Brillouin zone, concept of effective mass and holes.

Unit-II (Marks = 14)
Review of Electric & Magnetic Properties:
Electric Properties: Conductivity of metals, Ohm's Law, relaxation time, collision time and mean free path, electron scattering and resistivity of metals, heat developed in current carrying conductor, Superconductivity, Type I & Type II superconductors, Meissner Effect, Hall Effect.

Magnetic Properties: Introduction to magnetic materials-Origin of dipole moment, Classification of Magnetic Materials, Origin of Magnetic moment, Origin of dia, para, ferro and antiferro magnetism and their comparison, Langevins' theorem for diamagnetism & paramagnetism, Ferromagnetic materials, Saturation Magnetisation and Curie temperature.

Unit-III(Marks=12)
Classification of solids: Conductor, insulator, dielectric strength, dielectric constant, Polarization, Polarization mechanisms and total polarization, Ferroelectric Materials, Spontaneous Polarization, Curie-Weiss Law, Classification, Piezoelectricity, Dielectrics in Alternating Fields, Temperature and Frequency dependence of dielectric constants.

Unit-IV (Marks = 10)
Electrostatic and Electricity:

Coulomb's law, Gauss's law, Concept of electric potential, work & energy in electrostatics, electrostatics field in matter concept of electric displacement, Lorentz force, bio-savart law, Ampere's law, concept of magnetic vector potential, comparison of magnetostatics & electrostatics, Faraday's law of electromagnetic induction, Kirchoff's current &. voltage laws.

Suspension Galvanometer, torque and deflection of the galvanometer, moving coil galvanometer. Ammeters, voltmeters (AC & DC), ohmmeters.

Unit-V (Marks=12)
Electrical and Electronics Components:

Ideal voltage source, Ideal current source, Constant voltage source, Constant current source.

Resistors: Resistance, low resistance, effect of temperature on resistance, power rating, fixed and variable resistor, colour code, tolerance, combination of resistors, thermistor.

Capacitor: Concept of capacitor and capacitance, parallel plate capacitor, Energy stor in capacitor,, paper capacitor, electrolytic capacitor, Tantalum and ceramics capcitors, air capacitor(gang and field type), Voltage rating in circuit(CR, LC, LCR), combination of capacitor.

Inductors: Inductance, inductive reactance, self & mutual reactance, solenoids, iron core and ferrite core inductors, coefficients of inductors, quality factor, resonance circuits, couple circuits, variable inductor, combination of inductor.

Suggested Text & Reference Books:

1. H. E. White, Introduction to Atomic Physics, McGraw Hill .
2. A. J. Dekker, Solid State Physics, Macmilan.
3. B. L. Thareja, Electrical Engineering.
4. D. N. Vasudeva, Fundamentals of Magnetism and Electricity, S. Chand.

Course Code	Subject	Marks	L	T	P	C
CP-2-ELE- 102	Lab Course -1	40	0	0	2	2

PAPER-CP-2-ELE-102 **Total Class = 64**
Total Marks = 40
Electronics Practical-1

1. To identify ten different passive components from a collection of different values and types of the components. Write the values of each component if any code is available on the components.

2. To determine the frequency and peak to peak voltage of a sinusoidal wave generated by a function generator using a CRO, and compare the result with the input values given from the function generator.

3. To measure the values of five resistors in Series, Parallel and Mixed combination using a multimeter and compare the results with the value calculated by the colour code on the resistors.

4. To identify terminals of a diode and a transistor using multimeter.

5. To study measurement of voltage & current of a source by using Voltmeter and Ammeter.

6. To find out the value of five capacitors having colour codes or dots or number codes of capacitors. Write also type of capacitor.

7. To measure the output voltage of a power supply without load and with load and hence calculate the percentage of regulation.

8. To study voltage divider network.

9. To measure current through a resistance from cells when the cells are connected in

   i) Series, ii) Parallel and iii) Mixed combination

ELECTRONICS
Core (Major)
SEMESTER – II
TOTAL MARKS - 60

Code (Paper)	Title	Marks	L	T	P	C
CT-3-ELE- 201	Solid State Devices	60	3	0	0	3

Unit-I (Marks = 12)
Fundamentals of Semiconductors: Energy band theory of semiconductor, Intrinsic and extrinsic semiconductor, Majority and minority carrier, Mobility, current density and conductivity, Derivation of Fermi level for intrinsic semiconductors, Donors, Acceptors, Carrier concentration at normal equilibrium in intrinsic semiconductors, Dependence of Fermi level on temperature and doping concentration.

Unit-II (Marks=10)
Semiconductor Diodes: p-n junction diode, Properties of p-n junction, I-V characteristics of p-n junction, Formation of depletion layer, Space charge at a junction, Depletion width and depletion capacitance of abrupt p-n junction, Diode equations and the I-V characteristics, Zener and Avalanche mechanism.

Unit-III (Marks = 6)
Special diodes: Zener diode, Varactor diode, Tunnel diode, Schottky diode, LED, Solar cell.

Unit-IV (Marks=10)
Diode Circuits: Ideal diode, dc load line analysis, Quiescent (Q) point), Positive, negative and biased clipper circuits, Clamping circuits. Half wave rectifier, Center tapped and bridge fullwave rectifiers, Calculation of efficiency and ripple factor.

Unit-V (Marks=12)
Transistors: PNP and NPN transistor, Transistor biasing, Transistor circuit configuration(CB, CE, CC), Relation between α and β, leakage current, thermal runaway, static characteristics (CB & CE), Transistor as a switch, JFET , MOSFET, types of MOSFET, UJT (Construction, working and I-V characteristics of UJT), Basic construction and Characteristics of Thyristor, SCR.

Unit-VI (Marks=10)
Solid state Microwave Devices: IMPATT, TRAPAIT, BARITT diodes, basic idea of Gunn & PIN diodes. Basic idea of travelling wave tubes (TWT).

Suggested Text & Reference Books:

1. S. M. Sze, Semiconductor Devices: Physics and Technology, John Wiley & Sons.
2. Ben Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education.
3. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons.
4. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education.
5. Dennis Le Croissette, Transistors, Pearson Education.

Core (Major) Practical
SEMESTER – II
TOTAL MARKS - 40

Course Code	Subject	Marks	L	T	P	C
CP-2-ELE- 202	Lab Course -2	40	0	0	2	2

Two experiments (6 hours) to be appeared in the examination

1. To study the characteristic of R-L-C series Network.
2. To study the characteristics of R-L-C parallel Network. Find the quality factor (Q).
3. To study the R-C circuit as basic
   I. Integrator.
   II. Differentiator.
4. To study the voltage division and current division in a network.
5. To study V-I characteristics of a semiconductor diode.
6. To study V-I characteristics of a Zener diode.
7. To design and study half wave rectifier circuit.
8. To design and study full wave rectifier circuit.
9. To design a chipper and clamper circuit using junction diode.
10. To design a half wave voltage doubler using semiconductor diode.
11. To design a full wave voltage doubler using semiconductor diode.
12. To study a NPN/PNP transistor in CE and CB mode and plot the I-V characteristics.
13. To study transistor as a switch and amplifier.

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 301	Analog Electronics-I	60	3	0	0	3

PAPER - CT-3-ELE- 301 **Total Class = 64**
Total Marks = 60
Analog Electronics - I

Unit-I (Marks=10)
DC power supply: Block diagram of a power supply, Qualitative description of shunt capacitor filter, Regulated power supply using Zener diode , Temperature coefficient of Zener diode.

Unit-III (Marks=20)
Transistor biasing and Amplifier design: Transistor as an amplifier, Two-port representation of transistor, Analysis of transistor amplifiers, Transistor biasing and stabilization.

Classification of transistor amplifiers, Small signal amplifiers, Concept of amplification, Current gain, Voltage gain and power gain, Input and output resistance, Q-point, Load line, AC equivalent circuit using h-parameters, Determination of h-parameters, RC coupled amplifiers, Impedance coupled and transistor coupled amplifiers, Noise in amplifiers.
CS amplifier: CS amplifier circuit analysis, Qualitative study of frequency response of CS amplifier.

Unit-III (Marks=12)
Power Amplifier: Class A, B, C and class AB amplifiers, Direct coupled (d. c. amplifier, Darlington pair), push-pull amplifier, class B push-pull circuits, complementary symmetry amplifier, distortion in amplifiers, Applications of power amplifier.

Unit-IV (Marks=10)
Feedback Amplifiers:
General theory of feedback, negative & positive feedback, advantages of negative feedback, types of negative feedback in transistor amplifier, current series, voltage series, current shunt, voltage shunt amplifiers, emitter follower and biasing, cascaded configuration.

Unit-V (Marks=8)
Introduction to Operational Amplifier:
Concept of differential amplifiers, block diagram of an operational amplifier (IC 741), input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.

Suggested Text & Reference Books:

1. Boylestad & Nashalsky, Electronic devices & circuit theory: Pearson Education.
2. Millman- Halkias, Electronic device & circuit: Tata McGraw Hill.
3. J B Gupta, Electronic device & circuits, KATSON Publication.
4. Ryder, Electronic Fundamentals & Applications, PHI
5.Malvino, Electronic Principles, Tata McGraw Hill.

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 302	Quantum Mechanics & Engineering Materials.	60	3	0	0	3

PAPER- CT-3-ELE-302 Total Class = 64
Total Marks = 60
Quantum Mechanics & Engineering Materials

Unit-I (Marks = 8)
Wave Particle Duality: Inadequacies of Classical physics, Compton's effect, Wave-particle duality, de Broglie waves, Davisson and Germer's experiment, Group and Phase velocities, Wave Packets, Heisenberg's uncertainty principle: Derivation from wave-packets

Unit-II (Marks=12)
Quantum Mechanics: Basic postulates and formalism of quantum mechanics: probabilistic interpretation of waves, conditions for physical acceptability of wave functions. Schrodinger wave equation for a free particle and in a force field (1 dimension), Boundary and continuity conditions. Operators in Quantum Mechanics, Conservation of probability, Time-dependent form, Linearity and superposition, Operators, Time-independent one dimensional Schrodinger wave equation, Stationary states, Eigen-values and eigen-functions.

Unit-III(Marks=8)
Atoms in electric and magnetic fields:
Electron spin, Spin and Orbital angular momentum, Quantization and Larmor's theorem, Atoms in external magnetic fields: Zeeman effect, Stark Effect.
Pauli's exclusion principle, Atomic Shell Model, Periodic table, Introduction to spin orbit coupling.

Unit-IV (Marks=12)
Electron Emission and Vacuum Tubes: Classification of electron emission, thermionic emission, photoelectric emission, secondary emission, high field emission, Richardson's equation, Child- Langmuir law, vacuum tubes—diode and triode valve.

Unit-V (Marks=8)
Introduction to Modern Materials: Ceramics, Polymers and Composites. Nanomaterials, Solar cell materials, superconducting materials.

Unit-VI (Marks=12)
IC Technology: Introduction to integrated circuit technology, Monolithic IC, Technology of substrate preparation, Monolithic components in Ics (resistor, capacitor), Fabrication of semiconductor diode, Transistor, MOS transistor fabrication.

Suggested Text & Reference Books:

1. Banerjee and Streetman, Solid state electronic devices, Pearson Education.
2. A. J. Dekker, Electrical Engineering Materials, Prentice Hall India.
3. A. J. Dekker, Solid State Physics, Macmilan
4. P. Bhattacharya, Semiconductor optoelectronics device, Pearson Education.
5. M. Ohring, The material science of Thin films, Academic Publication.
6. A. Beiser, Concepts of Modern Physics, McGraw-Hill Book Company .
7. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications,

Macmillan India.

Course Code	Subject	Marks	L	T	P	C
CP-2-ELE- 303	Lab Course -3	40	0	0	2	2

PAPER- CP-2-ELE-303 **Total Class = 64**
Total Marks = 40
Lab Course – 3

For two experiments (6Hrs) to be appeared in the examination.

1. To verify the current-voltage characteristics for an inductance in AC circuit and hence to measure the value of inductance.
2. To determine its h-parameters of a transistor in CE mode.
3. To study the characteristics of Emitter follower of PNP & NPN transistor.
4. To study a crystal as detector, and verify square law detection.
5. To study the characteristics of a field effect transistor.
6. To design and study the RC coupled amplifier using NPN transistor in CE mode.
7. To study a OPAM as inverting and non-inverting amplifier.
8. To use OPAM as summer, Integrator and Differentiator.
9. To study the characteristics of negative feedback using Op-amp and NPN transistor.

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 401	Electrical Circuit & Engineering Mathematics	60	2	1	0	3

4th Semester
PAPER - CT-3-ELE - 401
Total Marks = 60
Title:**Electrical Circuit & Engineering Mathematics**

Unit-I (Marks=15)
AC Circuits
Peak, Average and RMS values for Alternating currents, Power calculation, reactive power, active power ,complex power, power factor, impedance, reactance, conductance, Sinusoidal circuit analysis for RL, RC and LCR circuits, Resonance in series and parallel LCR circuits, frequency response of series and parallel RLC circuits, Q-factor & Bandwidth.

Unit-II (Marks=15)

Transformers: Magnetic circuits, self and mutual inductance, Basic transformer operation and principle, Construction, Voltage relations, Current relations, Linear circuit models, Open circuit test, Short circuit test, Transformer efficiency, Variac.

Unit-IV (Marks=12)

AC Bridges: Wheatstone bridge, Basic principles and working of a potentiometer, Generalized Wheatstone bridge, Anderson Bridge, Maxwell's bridge, Schering bridge, Wien bridge, Application of AC bridge.

Unit-IV (Marks=18)

Engineering Mathematics: Fundamentals of probability, Bayes' theorem, Random variable, Mathematical expectation, sum and products of expectation, moments and their properties. statistical averages, transformation of random variables; Discrete and continuous distributions, Binomial, Poisson and Normal distribution; random process, stationarity, mean, correlation and covariance,

Suggested Text and Reference Books:

1. Rajeshswaran, Electric circuits, Pearson Education.
2. B. L. Thareja, Electrical Engineering.
3. G.K. Mittal, Network Analysis, Khanna Publication.
4. V.K. Aatre, Network Theory and Filter Design, Wily Eastern Ltd.
5. Del Toro, Fundamentals of Electrical Engineering, PHI.
6. S. C. Gupta & V. K. Kapoor, Fundamental of Mathematical Statistics, S. Chand & Sons

4th Semester
PAPER - CT-4-ELE - 402
Total Marks = 80
Digital Electronics

Unit -1: (Marks 12)
Number System and Base Conversion: Decimal, Binary, Octal, Hexadecimal and BCD number system, compliment Technique, addition, Subtraction, Multiplication of different system.
Boolean Algebra: Boolean postulates from basic gates, properties of Boolean algebra, De Morgan's theorem, simplification of Boolean expressions using K-map.
Codes: Need of Coding, Weighted codes (BCD), Exess - 3 code, Gray code and conversion, Alpha numeric code- ASCII and EBCDIC, Decimal to binary encoder, octal to binary encoder. Decoders, BCD- to-7 segment decoder, Realization of ROM.

Unit - II : (Marks 12)
Logic gates & Family: Basic Logic operation, AND, OR, NOT, NAND, NOR, XOR, gates. Universal gales, Truth tables, Bipolar logic families, DTL families, RTL families, TTL families, Schottky TTL, Emitter coupled logic (ECL), MOS and CMOS ICs as inverter, NAND and NOR gates, voltage transfer function. Fan-out, Noise-immunity and propagation delay of logic families.

Unit – III : (Marks 15)
Combinational Circuits: Half adder, Full adder, parallel binary adder. Half subtractor. Full subtractor, parallel subtractor, subtraction using full adder, 4-bit adder/subtractor. Binary multipliers, Magnitude comparator, Multiplexer, Demultiplexer, Encoder, Decoder.

Unit – IV: (Marks 12)
Flip-flops: Combinational and sequential circuits, flip-flops, NAND flip-flop, SR flip-flop, Clocked SR flip-flop, D-latch, JK flip-flop, Master-slave flip-flop, Edge-triggered devices, Application of flip-flops.

Unit – V: (Marks 14)
Counters: Asynchronous counter, Asynchronous decade counter, Synchronous counters, Up/down counters, Self stopping counter, Sequential counter design procedure and applications.
Shift Registers: Serial in shift registers, parallel-in shift register, universal shift register, 3-bits CMOS shift register.

Unit –VI : (Marks 15)

Memory: Introduction: RAM, ROM, PROM, EPROM, secondary memory, floppy, Hard disk, Magnetic storage, programmable logic devices.

ADC and DAC: Digital to analog converter, Weighted Register DAC, R-2R ladder DAC, Analog to digital converter, Successive approximation ADC, parallel ADC, Dual slope ADC, IC ADC 0809.

Suggested Text and Reference Books:

1. R.L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill.
2. Donald P. Leach, Albert Paul Malvino, Digital Principles and Applications, Tata McGraw Hill.
3. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education Asia.
4. Thomas L. Floyd , Digital Fundamentals, Pearson Education Asia.
5. S.P. Bali, Solved Problems in Digital Electronics, Sigma Series, Tata McGraw Hill.
6. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India.
7. R.P. Jain , Modern Digital Electronics, Tata McGraw-Hill.

Course Code	Subject	Marks	L	T	P	C
CP-3-ELE- 403	Lab Course -4	60	0	0	3	3

4th Semester
PAPER-CP-3-ELE – 403 **Total Class = 96**
Total Marks = 60
Lab Course – 4

Two experiments (6hrs) to be appeared in the examination.

1. To study AND, OR, NOT and XOR gates using RTL and gate ICs.
2. To study AND, OR, NOT and XOR gates using NAND gates.
3. To simplify Boolean expression and realization using logic gate circuit and assemble it using logic gate ICs.
4. To design and study a seven-segment Display driver.
5. Design and study a Half and Full adder.
6. Design and study a Half and Full Subtractor.
7. Design and study a 4x1 Multiplexer using logic gates.
8. To design and study Flip-Flop Circuits using logic gates (RS, Clocked RS, D-type, and JK Flip-Flop).
9. Design a 4 bit Counter using Flip-Flop.
10. To design and study shift register using Flip-Flop.
11. To design and study a digital to analog converter using R-2R ladder network.
12. To design and study analog to digital converter.
13. To measure the self-inductance of an inductor by Anderson bridge.

Semester: V

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 501	Network Analysis & Network synthesis	60	3	0	0	3

PAPER - CT- 3- ELE – 501 Total Class = 64
Total Marks = 60
Network Analysis & Network Synthesis

Unit-I (Marks =12)
Network Theorem and Functions:
Network elements, Superposition theorem, Milman theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem.

Network Function, Complex frequency and the s-plane, properties of poles and zeros in the complex plane, Network functions for one port and two port networks, poles and zeros of network functions, restrictions on locations of poles and zeros, Time domain response from pole and zero plot, Significance of poles & zeros of a network function.

Unit-II (Marks =12)
Two port Networks:
Short circuit admittance parameters, open circuit impedance parameters, relation between Z- and Y-parameters, Transmission parameters (A,B,C,D,), A B C D parameters in terms of Z- and Y-parameters, hybrid parameters, g- parameters; input, impedance in terms of Z, Y-, ABCD- parameters; output impedance in terms of Z, Y, ABCD- parameters; T-section representation, pi-section representation, Image impedances. Symmetrical Networks, Ladder Networks, Lattice Networks.

Unit-III (Marks = 10)
Laplace Transformation: Laplace Transform, Inverse Laplace Transform, Properties of the Laplace transform, Solving Differential Equations with initial conditions, Laplace transform methods in Circuit Analysis, Step response of RL, RC and RLC circuits, Determination of network response with Laplacian transform, Response of networks to a pulse series.

Unit-IV (Marks = 10)
Fourier Transformation: Fourier analysis of periodic function, Fourier coefficients, Fourier of complex function, Introduction of Fourier Transform, Fourier transform of step voltage and rectangular pulse, Use of Fourier transforms to describe input waveforms, Continuous-Time periodic signals, Convergence of the Fourier series,

Properties of continuous-Time Fourier series, Discrete-Time periodic signals, Properties of Discrete-Time Fourier series.

Unit-V (Marks = 8)

Network filters:

Constant K-type filters (low pass, high pass, band pass & band elimination), m- derived fitters, Delay network, Attenuators and attenuating pads.

Unit-VI (Marks = 8)

Network Synthesis

Introduction to Network Synthesis, Reactive network, Driving point immittance, Separation property of Reactive network, Foster's Reactance Theorem, Equivalent network using Foster's theorem.

Suggested Text and Reference Books:

1.G.K. Mittal, Network Analysis, Khanna Publication.
2. A. V. Oppenheim, A. S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education
3. H. P. Hsu, Signals and Systems, Tata McGraw Hill.
4. M. Roberts, Fundamentals of Signals and Systems,Tata McGraw Hill.
5. S. T. Karris, Signal and Systems: with MATLAB Computing and Simulink Modelling, Orchard Publications.

Semester: V

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 502	Electromagnetic Wave propagation & Antenna	60	3	0	0	3

PAPER - CT-3-ELE- 502 Total Class = 64
Total Marks = 60
Electromagnetic Wave Propagation & Antenna

Unit-I (Marks =20)

Equation of continuity, displacement current, Maxwell equation, scalar and vector potential. Gauss transformations, Poynting theorem, conservation of energy and momentum for electromagnetic fields.

Maxwell's wave equation, the plane wave, polarization of electromagnetic waves, linear and circular polarization, reflection, refraction and dispersion, polarization by reflection and total internal reflection.

Electromagnetic waves in the non-conducting media, reflection & transmission at oblique incidence, Snell's law, Fresnel's equation, Brewester's angle, electromagnetic waves in conducting media, skin depth, reflection & transmission at a conducting surface.

Electromagnetic spectrum, propagation of radio wave, ground waves & space waves, reflection of space waves from different layer of ionosphere, characteristics of various propagation media with reference to LF, HF, VHF and microwave signals.

Unit-II (Marks=16)

Basic concept of transmission line, low & high frequency transmission line, distributed parameters, types of transmission line, voltage & current relation on radio frequency transmission line, characteristics impedance, transmission line as circuit element, voltage & current relation with distance from load end or receiving end, line terminator, propagation constant, conditions for distortion less transmission with minimum attenuation, loss free line, short circuit & open circuit lines, standing wave ratio, phase factor, reflection & transmission co-efficient, transmission Line matching, maximum power transfer.

Unit-III (Marks=10)

Introduction to wave guide, rectangular wave guide, solution of wave equation, TE and TM modes, total internal reflection, calculation of wave impedance, cut-off frequency, phase constant and wavelength, brief idea about cylindrical wave guide and micro strips.

Unit-IV (Marks=14)

Basic antenna principles, Wire and Aperture Antennas**,** the Retarded Potential, Hertzian Dipole, Radiated Power, Radiation Resistance, Antenna Characteristics, Antenna Patterns, Radiation Intensity, Directive Gain, radiation fields, polarization, isotropic radiator, power gain of microwave antennas, folded dipole, rhombic & yagi antenna & their radiation pattern, vertical antenna, microwave antennas, antenna equivalent.

Half-wave Dipole Antenna, Quarter-Wave Monopole Antenna, Small Loop Antenna, Aperture Antenna, Antenna Arrays.

Suggested Text and Reference Books:

1. W. H. Hayt and J.A. Buck, Engineering Electromagnetics, Tata McGraw Hill
2. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Press
3. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education
4. J. A. Edminster, Electrmagnetics, Schaum Series, Tata McGraw Hill

Semester: V

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 503	Analog Communication	60	3	0	0	3

PAPER - CT- 3 – ELE – 503 **Total Class = 64**
Total Marks = 60
Analog Communication

Unit-I (Marks =16)
Signal and Systems: Signals and system and their classification, Fourier analysis of Signals, Fourier Series representation of Signals(Continuous-Time periodic signals, Convergence of the Fourier series, Properties of continuous-Time Fourier series, Fourier Transform representation of signals : Aperiodic signals, Periodic signals, Properties of Continuous-time Fourier transform; Time domain and frequency domain. Sampling theorem.
Concept of Noise: Different types of noise, Thermal, Shot Flicker noise, signal to noise ratio, noise factor, noise temperature, Basic communication system.

Unit-II (Marks = 12)
Modulation: Need of modulation, Amplitude modulation, Expression for AM and spectrum, modulation index and percentage modulation, generation of AM, non-linear devices, basic principle of DSB, SSB, VSB (Vestigial Side Band modulation).
Angle modulation: Frequency and Phase modulation, modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM (direct and indirect methods).

Unit-III (Marks = 8)
Detection: Linear diode detector, detection characteristics of diode and its uses, diode for automatic volume control, square law diode detection, Frequency demodulation, discriminator. Comparison between AM, FM and PM.

Unit-IV(Marks=12)
Transmitters: Communication channels for AM and FM broadcast, AM transmitter: Low level and high level modulation, FM transmitter
Receivers: Receiver parameters: sensitivity, selectivity and fidelity, Super Heterodyne Receiver, Double Conversion Receiver. AM receivers, FM receivers. Frequency Division Multiplexing.

Unit-V (Marks=12)

Picture elements, principle of image transmission, TV camera tubes, Image orthicon & vidicon, electron beam scanning, synchronization-horizontal & vertical synchronization pulses, blanking horizontal & vertical.

Telephony, Telegraphy, radar, block diagram of pulsed & CW radar transmitter & receiver, radar range equation, power & frequency consideration, e-mail, fax, internet, mobile communication, basic principle of satellite communication.

Suggested Text and Reference Books:

1. G. Kennedy and B. Davis, Electronic Communication Systems, Tata McGraw Hill.
2. W. Tomasi, Electronic Communication Systems: Fundamentals through Advanced, Pearson Education.
3. R. P. Singh and S. D. Sapre, Communication Systems: Analog and Digital, Tata McGraw Hill.
4. L. E. Frenzel, Communication Electronics: Principles and Applications, Tata McGraw Hill.
5. L. W. Couch II, Digital and Analog Communication Systems, Pearson Education.
6. T. G. Thomas and S. Chandra Sekhar, Communication Theory, Tata McGraw Hill.
7. S. Haykin, Communication Systems, Wiley India.

Semester: V

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 504	Instrumentation	60	3	0	0	3

PAPER - CT- 3 - ELE – 504 Total Class = 64
Total Marks =60

Instrumentation

Unit I (Marks =12)

Qualities of Measurement: Units: S. I. system of units, dimensions and standards; errors in measurement, types of static error, sources of errors.

Basic Measurement Instruments: DC measurement: dc voltmeter, ohmmeter and ammeter. Digital type voltmeter, ammeter and ohmmeter, digital multimeter, AC measurement: voltmeter, ammeter. Digital frequency meter: elements of frequency meter, digital LCR-Q meter, digital wattmeter.

Unit II (Marks=14)

Signal Generators: Types of generators and their operation: Audio oscillator, Function generators, Pulse generators, RF generators, Random noise generators.

Probes and Connectors: Test leads, shielded cables, connectors, low capacitance probes, high voltage probes, RF demodulator probes, special probes for IC's, current probes.

Unit III (Marks=18)

Electronic Displays: The Cathode Ray Oscilloscope (CRO): Block diagram of a General Purpose oscilloscope and its basic operation, electrostatic focusing and deflection, CRT connections, CRO probes. Types of CRO's: dual trace ocilloscope, digital storage oscilloscope.

Wave Analyzers: Operation of frequency selective wave analyzers and heterodyne wave analyzers and their application. Spectrum analyzer.

Unit IV (Marks=16)

Transducers: Various types of transducers for measurement of displacement, speed, stress and strain, Classification and selection of transducers, transducer sensitivity, Position Transducer: capacitive, inductive, linear variable differential transformer (LVDT), Piezoelectric, potentiometric, Temperature transducers.

Suggested Text and Reference Books:

1. H. S. Kalsi, Electronic Instrumentation, Tata McGraw Hill.
2. Joseph J Carr, Elements of electronic instrumentation and measurement, Pearson Education
3. C. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata McGraw Hill.
4. H. Cooper, Modern electronic instrumentation and measurement techniques, Pearson Education
5. R. A. Witte, Electronic test instruments: analog and digital measurements, Tata McGraw Hill.
6. S. Wolf and R. F. M. Smith, Student Reference Manual for Electronic Instrumentation Laboratories, Pearson Education.

Semester: V

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 505	Digital Communication	60	2	1	0	3

PAPER - CT-3-ELE – 505 **Total Class = 64**
Total Marks = 60
Digital Communication

Unit-I (Marks =16)

Pulse Analog Modulation: Introduction to digital communication, Sampling theorem, Errors in Sampling. Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM), Generation and detection of PAM, PWM, PPM, Time Division Multiplexing (TDM).

Unit-II (Marks = 18)

Pulse Code Modulation: Introduction to digital communication Pulse Code Modulation, Need for digital transmission, Quantization Noise, Transmission noise and Bit Error Rate. Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation.

Unit-III (Marks=12)

Digital Carrier Modulation Techniques: Digital transmission and reception Techniques. Information capacity, Bit Rate, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK).

Unit-IV (Marks=14)

Multiple Access Techniques: Concept of Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), Time Division Multiple Access (TDMA).

Overview of Modern Communication Systems: Base band transmission, Modem principle and architecture, Mobile Communication, Satellite Communication and Optical Communication.

Suggested Text & Reference Books:

1. H. Taub and D. Schilling, Principles of Communication Systems, Tata McGraw Hill
2. W. Tomasi, Electronic Communication Systems: Fundamentals through Advanced, Pearson Education
3. L. E. Frenzel, Communication Electronics, Principles and Applications, Tata McGraw Hill
4. L. W. Couch II, Digital and Analog Communication Systems, Pearson Education
5. H. P. Hsu, Analog and Digital Communications, Tata McGraw Hill
6. S. Haykin, Communication Systems, Wiley India

Semester: V

Course Code	Subject	Marks	L	T	P	C
CP-4-ELE- 506	Lab Course -5	80	0	0	4	4

PAPER – CP - 4 – ELE – 506 Total Class = 128
Total Marks = 80
Lab Course – 5

Two experiment (6hrs) to be appeared in the examination.

1. Study of Amplitude Modulation and Demodulation.
2. Study of Frequency Modulation and Demodulaton.
3. Study of Single Side Band Modulation and Demodulation.
4. Study of AM Transmitter and Receiver.
5. Study FM Transmitter and Receiver.
6. Study of Pulse Amplitude Modulation
7. Study of Pulse Width Modulation
8. Study of Pulse Position Modulation
9. Study of Delta Modulation
10. Study of Pulse Code Modulation
11. Study of Phase Shift Keying / Frequency Shift Keying / Quadrature Phase Shift Keying.(anyone)
12. Study of Time Division Multiplexing
13. To study the I-V Characteristics of SCR
14. To study the I-V Characteristics of Diac and Triac

Semester: V

Course Code	Subject	Marks	L	T	P	C
PR-2-ELE- 507	Project Phase I	40	0	0	2	2

PAPER-PR- 2 – ELE - 507 **Total Class = 64**

Total Marks = 40

Project Phase - I

(One project work has to be completed with dissertation on the above studied papers under guidance of one lecturer of the concerned department.)

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 601	Optoelectronics	60	2	1	0	3

PAPER - CT-3 –ELE – 601 **Total Class = 64**
Total Marks = 6
Optoelectronics

Unit I (Marks = 8)
Electronic properties of semiconductors: Effect of pressure & temperature on band gap, electron- hole pair formation and recombination, injection efficiency, heterojunction, internal quantum efficiency, double hetero-juction, quantum well, quantum dot and superlattices;

Unit II (Marks =12)
Optical fiber, principle of fabrication, types of optical fiber, characteristic parameters, modes, single mode, multi-mode fiber, transmission through fiber, advantage of optical communication, conceptual set up of an optical communication System

Fibre optical wave guide, step index fiber, concept of graded index, dielectric waveguide, total internal reflection, fibre splicing, low dispersion fibres, losses in fibres, fibre jointing.

Unit III (Marks = 14)
Spontaneous emission, absorption and stimulated emission, population inversion, Einstein A & B co-efficient, properties of laser, gain coefficient, pumping processes, optical resonator, types of resonator. laser diode, threshold current and power output, hetero-junction lasers, distributed feedback lasers, quantum well lasers, surface emitting and rare earth doped lasers, mode locking.

Semiconductor optoelectronic materials, LED, light output from LED, characteristics, manufacturing process and application of LED.

Unit IV (Marks =14)
Photodetectors: Thermal detectors, photoconductors, junction photo diodes, avalanche photo diode, optical heterodyning and electro-optic measurements, phototransistors, modulated barrier photo diode, schottky barrier photo diode, detectors for long wavelength operation, micro cavity photodiode, solar cells: I-V characteristics and spectral response, materials and design considerations of solar cells.

Unit V (Marks=12)

Display devices: Photoluminescence, electroluminescence and cathodoluminescence displays, displays based on LED, plasma panel and LCD, optoelectronic modulation and switching devices.

Suggested Text & Reference Books:

1. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India .
2. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education .
3. Gerd Keiser, Optical Fiber Communications, Mc.Graw hill International.
4. Pallab Bhattacharya, Semiconductor Optoelectronic Devices, Pearson Education.
5. Jasprit Singh, Semiconductor Optoelectronics, John Wiley.

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 602	Microprocessor &Microcontroller	60	3	0	0	3

PAPER - CT-3-ELE – 602 Total Class = 64

Total Marks = 60

Microprocessor and Microcontrollers

Unit-I (Marks=16)

Introduction to microprocessors and microcomputers, memory: primary & secondary memory machine language, assembly language and high level language. Microprocessor architecture, types of buses, registers, memory mapping. Basic idea of INTEL 8085, 8086. Microprocessor: pin-out diagram, classification of the signals, bus timings, types of machine cycles and their functioning.

Unit-II (Marks=18)

8085 Programming:

8085 programming model: Accumulator, register and flags, instruction classification & programming concepts, stack and subroutine (CALL and RET statements), delay subroutines, Code conversion, BCD Arithmetic, introduction to transmission format, modes of data transfer.

Interrupts: Maskable and non-maskable interrupts, RST (Reset), vectored interrupts & instructions (SIM & RIM).

Unit-III (Marks=14)

Stack and Subroutines

Memory Mapping, Serial and Parallel I/O & Memory Interfacing with 8085, Programmable I/O and DMA, Memory Mapped I/O and I/O Mapped I/O techniques.

Peripheral Devices: 8255-Programmable Peripheral Interface, 8253- Programmable interval Timer, 8259- Priority Interrupt Controller, 8279-Programmable Keyboard/Display Interface, 8251- USART, 8237/8257- Programmable DMA Controller

Unit-IV (Marks=12)

Microcontrollers:

Introduction to microcontrollers, advantages of microcontrollers. 8031/8051 Microcontroller; Architecture, register bank, flags, special function registers, I/O ports, timers, serial communication, interrupts, instruction set.

Suggested Text & Reference Books:

1. R. S. Gaonker, Microprocessor Architecture, Programming and Applications with the 8085, PRI-Penram International Publishing.
2. P.K Sridhar and P.R Ghosh, 0000 to 8085: Introduction to Microprocessors, Prentice Hall of India.
3. B. Ram, Introduction to Microcomputer and Microprocessor, Dhanpat Rai and Sons.
4. M.A. Mazidi and J.G. Mazidi, 8051 Microcontroller & Embedded Systems, Prentice Hall India.
5. A.P. Mathus, Introduction to Microprocessors, Tata McGraw-Hill.

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 603	Analog Electronics-II	60	3	0	0	3

PAPER - CT-3-ELE- 603 **Total Class = 64**

Total Marks = 60

Analog Electronics – II

Unit-I (Marks = 16)

Operational Amplifier

Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, summing and difference amplifier, Integrator, Differentiator, voltage to current converter, current to voltage converter, Basic comparator, Level detector, Voltage limiters, Regenerative comparator, Logarithmic amplifier, Anti-logarithmic amplifier.

Unit-II (Marks = 14)
Signal generators (Transistor and IC 741):
Phase shift oscillator, Wien bridge oscillator, Schmitt Trigger, Square wave generator, triangle wave generator, sawtooth wave generator, Voltage controlled oscillator (IC 566), Phase locked loop (PLL).

Unit-III(Marks=12)
Multivibrators (Transistor and IC 555):
Block diagram, Astable, monostable multivibrator and bistable circuit, Voltage to frequency (V/F) and frequency and voltage (F/V) converter.

Unit-IV (Marks =12)
Signal Conditioning circuits:
Sample and hold systems, Active filters: First order low pass and high pass Butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter.

Suggested Text & Reference Books:

1. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education
2. S. Franco, Design with operational amplifiers and analog integrated circuits, Tata McGraw Hill
3. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson Education.
4. J B Gupta, Electronic device & circuits, KATSON Publication.
5. Boylestad & Nashalsky, Electronic devices & circuit theory, Pearson Education.

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 604A	Power Electronics (Optional)	60	3	0	0	3

PAPER - CT-3-ELE- 604(A) **Total Class = 64**
Total Marks = 60
Power Electronics (Optional)

Unit I (Marks =12)
Concept of power diodes and power transistors, concept of thyristor technology, ratings, symbol, characteristics, turn on methods and turn off methods of thyristors, diacs, SCR,SVS,S BS, LASCR, triacs and MOSFETS, Internal power dissipation and need for heat sinks for these devices.

Unit II (Marks =16)
Basic Structure, principle of operation and VI characteristics of UJT, Explanation of working of UJT as relaxation oscillator and its use in thyristor, working principle of converters: single phase, three phase, half wave and full wave, half controlled, full controlled; Principle of operation of basic inverter circuit and chopper cicuit.
Principle of working of AC phase control circuit.

Unit III (Marks = 14)
Three terminal voltage regulator ICs (positive, negative and variable applications), Block diagram of a regulated power supply, Short circuit and overload protection. Major specifications of a regulated power supply and their significance (line and load regulation, output ripple and transients), Basic working principles of a switched mode power supply, Concept of floating and grounded power supply and their interconnections, Brief idea of CVT, UPS and dual tracking power supply.

Unit IV (Marks=18)
Principle of operation of following switching circuits, Automatic battery charger ,Voltage regulator, Emergency light, Time delay circuit, Fan speed control, Temperature control, speed control of DC and small DC motors, SMPS,UPS Static sensitive electronics Components, EC,(National Electrical Code), Ground faults, Isolation Transformers, Ground blocks and rods, Electrical or chemical fire extinguishers, Electrical shock, Leaded solder.

Suggested Text & Reference Books:

1. Rashid, Power Electronics ,PHI
2. K B Khanchandani, Power Electronics, Tata MG-Hill
3. Robert W Erickon & Dragan Maksimobic
4. M S Berdi, Thyristor engineering,Khanna publication
5. P C Sen, Power Electronics,TMH Ltd.

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 604 B	Consumer Electronics (Optional)	60	3	0	0	3

PAPER - CT-3-ELE- 604 (B) **Total Class = 64**
Total Marks = 60
Consumer Electronics (Optional)

Unit-I (Marks = 14)

Audio System: Microphones- construction, working principles and applications of microphones, their types viz. a) Carbon, b) Moving coil, c) velocity, d) crystal ,e) cordless etc

Loud Speaker: Direct radiating, horn loaded woofer, tweeter, midrange, multi-speaker system, baffles and enclosures.

Sound recording on magnetic tape, its principles, block diagram and tape transport mechanism.

Digital sound recording on tape and disc CD system: Hi-Fi system, pre amplifier, amplifier and equalizer system, stereo amplifiers.

Unit-II (Marks = 12)

Television: Monochrome TV Communication, Scanning: its need for picture transmission-Need for synchronizing and blanking pulses, Progressive scanning-Gross structure filters, interlaced scanning, resolution and band width requirement, Composite Video signal (CVS) at the end of even and odd fields, equalizing pulses and their need, Monochrome picture tube- construction and working, comparison of magnetic and electric deflection of beam,

Unit-III (Marks = 14)

Construction and working of camera tube:

Block diagram of TV camera and the transmitter, Block diagram of a TV receiver; Frequency range of various VHF bands & channels used in India, Major specification of the CCIR. Concept of positive and negative modulation VSB Transmission Tuner-Typical circuits of scanning and EHT stages of TV receiver, keyed. AGC, function and location of brightness contrast, Identification of faulty stage by analyzing the symptons and basic idea of a few important faults and there remedies.

Unit-IV (Marks = 12)

Colour schemes- Introduction to PAL,NTSC,SECAM systems, advertisement and disadvantages block diagram of video camera and its explanation –Construction and working principles of trinitran and PIL types of colour picture tubes, Concept of

convergence, purity of beam shifting- Block diagram of PAL TV receiver, explanation and working

Unit-V (Marks = 8)
Cable Television: Block diagram and principles of working of cable TV and DTH, Cable TV using internet.

Suggested Text & Reference Books:

1. R. R. Gulati, Colour Television – Principles & Practice, Wiley Eastern Limited.
2. R. R. Gulati, Complete Satellite & Cable Television, New Age International.
3. A. K. Maini, Colour Television & Video Technology, CSB Publishers.

Course Code	Subject	Marks	L	T	P	C
CT-3-ELE- 605	Introduction to Computer & Programming	60	3	0	0	3

PAPER - CT- 3 -ELE- 606 Total Class = 64
Total Marks = 60
Introduction to Computer and Programming

Unit-I (Marks=10)
Introduction to computer System, Block diagram of computer, CPU, MAIN Memory, I/O devices, Concept of machine language, and high level languages, Assembler, Compiler, interpreter.

Unit-II (Marks =15)
Introduction to Software, need of software, types of software, system software, application software, programming language, machine languages, high level languages. Introduction to Operating system and its function, Disk operating system, windows OS, Linux OS.

Unit-III (Marks=25)
Algorithm, flowchart, control loops, pseudo code, modular design of a program, program development cycle and environment.

Introduction to C, standard data types, Constant and variables, expressions, assignment, control statement, Functions and procedures, Parameter passing, Recursion, Sub-range and enumerated data types.

Unit-IV (Marks=10)
Introduction to MATLAB & SIMULINK, Introduction to numerical Methods.

Suggested Text & Reference Books:

1. Balaguruswamy, Programing with C.
2. Stallings : Computer organisation and architecture, Pearson Education.
3. V. Rajaram.: Computer fundamental.
4. J. R. Hubbard, Schaum's outline of theory and problems of programming with C, Tata McGraw Hill.

Course Code	Subject	Marks	L	T	P	C
CP-3-ELE- 606	Lab Course -6	60	0	0	3	3

PAPER-CP-3-ELE - 606 **Total Class = 96**

Total Marks = 60

Lab Course – 6

1. **Practicals using Micrproceessor and Microcontroller.**
2. **Programming in C**
3. **Programming in MATLAB**

Course Code	Subject	Marks	L	T	P	C
PR -3-ELE- 607	Project Phase II	60	0	0	3	3

PAPER-PR- 3 – ELE – 607 Total Class = 96

Total Marks = 60

Project Phase - II

(One project work has to be completed with dissertation on the above studied papers under guidance of concerned department.)

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