

# Society for Applied Microwave Electronics Engineering & Research

## Kolkata Centre

Plot L2, Block GP, Salt Lake Electronics Complex, Kolkata-700091

Ph: 033 2357 4875 / 4894 , email: [hrd@mmw.sameer.gov.in](mailto:hrd@mmw.sameer.gov.in)

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### Syllabus for Written Examination

Post Code: RSEL001

#### Networks, Signals and Systems

Network solution methods: nodal and mesh analysis; Network theorems: superposition, Thevenin and Norton's, maximum power transfer; Wye-Delta transformation; Steady state sinusoidal analysis using phasors; Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits; Linear 2-port network parameters: driving point and transfer functions; State equations for networks.

Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications;

Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals;

LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, digital filter design techniques.

#### Electronic Devices :

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell; Integrated circuit fabrication process;

#### Analog Circuits

Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: clipping, clamping and rectifiers; BJT and MOSFET amplifiers: Single-stage biasing, bias stability, mid-frequency small signal analysis and frequency response; multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters;

**Sinusoidal oscillators:** criterion for oscillation, single-transistor and op- amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits;

**Power supplies:** ripple removal and regulation.

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### Digital Circuits

#### Number systems;

**Combination circuits:** Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders and PLAs;

**Sequential circuits:** latches, flip-flops, counters, shift-registers and finite state machines;

**Data converters:** sample and hold circuits, ADCs and DACs

**Semiconductor memories:** ROM, SRAM, DRAM;

**8-bit microprocessor (8085):** architecture, programming, memory and I/O interfacing.

### Control Systems

**Basic control system components;** Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

### Communications

**Random processes:** autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems;

**Analog communications:** amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers, circuits for analog communications;

**Information theory:** entropy, mutual information and channel capacity theorem;

**Digital communications:** PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing and frequency synchronization, inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA.

### Electromagnetics

**Electrostatics;** Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector;

**Plane waves and properties:** reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth;

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**Transmission lines:** equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart;

**Waveguides:** modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers.

**Syllabus for Written Examination**

**Post Code: PAEL002**

1. Network Analysis
2. Transmission Lines
3. Semiconductor and diodes
4. Transistor, JFET, MOSFET & BJT
5. Types of amplifier
6. Rectifier and Power supply
7. Boolean algebra
8. Logic Circuits
9. Transformer & DC Motors

**Syllabus for Written Examination**

**Post Code: PAME003**

1. Work Shop Technology
2. Engineering Mechanics & Strength of Materials
3. Theory of Machines
4. Fluid Mechanics & Machinery
5. Thermal Engineering-I
6. Manufacturing Technology-I
7. Mechanical Measurements & Metrology

Date: 17.05.2022

the Chairman

Selection Committee, SAMEER Kolkata