GATE ECE Syllabus 2021

Given below is a detailed section-wise GATE ECE syllabus:

General Aptitude

This section has questions based on Verbal Ability and Numerical Ability. The various topics included in the GATE ECE syllabus for General Aptitude are as follows:

Verbal Ability:

1. English grammar,
2. Sentence completion,
3. Verbal analogies,
4. Word groups,
5. Critical reasoning and
6. Verbal deduction.

Numerical Ability:

1. Computation of numerical quantities,
2. Estimating numerical values,
3. Numerical reasoning and
4. Data interpretation.

Engineering Mathematics

The GATE ECE syllabus for Engineering Mathematics is as follows:

- **Linear Algebra:** Vector space, basis, linear dependence and independence, matrix algebra, eigenvalues and eigenvectors, rank, solution of linear equations – existence and uniqueness.

- **Calculus:** Mean value theorems, theorems of integral calculus, partial derivatives evaluation of definite and improper integrals, maxima and minima problems, multiple integrals, line, surface and volume integrals, the Taylor series.
- **Differential Equations:** First order equations (linear and nonlinear), higher-order linear differential equations, partial differential equations, variable separable method and application, initial and boundary value problems. Cauchy's and Euler's equations, the technique of solution through a variety of parameters, complementary function as well as particular integral.
- **Vector Analysis**: Vectors in plane and space, vector operations, gradient, divergence and curl, Gauss's, Green's and Stoke's theorems.
- **Complex Analysis:** Analytic functions, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem.
- **Probability and Statistics:** Mean, median, mode, standard deviation problems, combinatorial probability, binomial distribution, probability distributions, Poisson distribution, exponential distribution, normal distribution, joint as well as conditional probability.

Subject Specific Section

The subject-specific section includes topics from Networks, Signals and Systems, Electronic Devices, Analog Circuits, Digital Circuits, Control Systems, Communications, and Electromagnetic.

Networks, Signals, and Systems

- **Circuit analysis:** Node and mesh analysis, Thevenin's theorem, Norton's theorem, superposition, and reciprocity problems.
- **Sinusoidal steady-state analysis**: phasors, complex power, maximum power transfer.
- Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits. Solution of network equations through Laplace transform.
- Linear 2-port network parameters, wye-delta transformation.

- **Continuous-time signals:** Fourier series and Fourier transform, sampling theorem and applications.
- **Discrete-time signals:** DTFT, DFT, z-transform, discrete-time processing of continuous-time signals.
- **LTI systems:** Definition, properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, and phase delay.

Electronic Devices

- Energy bands in extrinsic and intrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors.
- **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, photodiode and solar cell.

Analog Circuits

- **Diode circuits:** Clipping, clamping and rectifiers.
- BJT and MOSFET amplifiers: Biasing, AC coupling, small-signal analysis, frequency response.
- Current mirrors and differential amplifiers.
- **Op-amp circuits:** Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

Digital Circuits

- **Number representations:** binary, integer and floating-point- numbers.

- **Combinatorial circuits:** Boolean algebra, minimization of functions via Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, and decoders.
- **Sequential circuits:** Latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, and critical path delay.
- **Data converters:** sample and hold circuits, ADCs and DACs.
- **Semiconductor memories:** ROM, SRAM, DRAM.
- **Computer organization:** Machine instructions, addressing modes, ALU, data path, control unit, and instruction pipelining.

Control Systems

- **Basic control system components;** The 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 as well as solution of state equation of LTI systems.

Communications

- **Random processes:** Autocorrelation and power spectral density, properties of white noise, filtering of random signals via LTI systems.
- **Analog communications:** amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers.
- **Information theory:** Entropy, mutual information and channel capacity theorem.
- **Digital communications:** PCM, DPCM, digital modulation schemes, bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER.
- Fundamentals of error correction, Hamming codes, CRC.

Electromagnetics

- **Maxwell's equations:** differential and integral forms as well as their interpretation, boundary conditions, wave equation, and Poynting vector.
- **Plane waves and properties:** reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.
- **Transmission lines:** equations, characteristic impedance, impedance matching, impedance transformation, S- parameters, and the Smith chart.
- Rectangular and circular waveguides, light propagation in optical fibres, dipole and monopole antennas, linear antenna arrays.