GITAM INSTITUTE OF TECHNOLOGY
GITAM UNIVERSITY

(Estd.u/s 3 of UGC Act, 1956)
Accredited by NAAC with 'A'Grade
Rushikonda, Visakhapatnam-530 045(AP)

GITAM Ph.D Admission Test - 2017

Electronics and Communication Engineering

Syllabus

Part A: Research Methodology

What is Research; Definitions, Research Process, Reasons for doing research, Outcome of Research, Sources of Research Ideas, Innovative Research, steps in Developing and Refining Research Problems, Basic vs applied research, Literature survey. Experimental Research, Experimental skills; Data analysis; Modeling skills Technical writing; Technical Presentations; Creativity in Research; Group discussion on Ethics in Research

Part B :

Section 1: 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.

Section 2: 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: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

Section 3: Analog Circuits

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

stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and opamp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation.

Section 4: Digital Circuits

Number systems; Combinatorial 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 and 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.

Section 5: 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.

Section 6: 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.

Section 7: 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; 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.

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MODEL QUESTIONS

Part – A: Research Methodology

Max Marks: 80

Summary, Writing and Citation Style **20 Marks**

Given checklist about Typographical, Plagiarism, References and Technical Content guidelines, write a summary (in 200 words) about your proposed research area of interest.

Multiple Choice Questions 20 Questions with 3 Marks Each **60 Marks**

Sample Questions

Q1) Assuming no modelling error, what is the effect of SNR on the quality of parameter estimates?

a) High value leads to poor estimates
b) High value leads to good estimates
c) Low value leads to poor estimates
d) None

Q2) In general, which of the following is used for linearizing a non-linear function?

a) Taylor's series expansion
b) Power series expansion
c) Fourier series expansion.
d) None of the above

Q3) Identify the methods for doing research

a) Transformation of facts
b) To test or disprove a theory
c) To come out with a better way
d) Information gathering

Part B: Electronics and Communication Engineering

Max Marks: 80

Twenty Questions: Marks = 1 x 20 = 20 **20 Marks**

Q1. A source $V_s(t) = V \cos 100\pi t$ has an internal impedance of (4+j3) Ω. If a purely resistive load connected to this source has to extract the maximum power out of the source, its value in Ω should be?

a) 3
b) 4
c) 5
d) 7

Q2) A ramp voltage, V(t) = 100t Volts, is applied to an RC differentiating circuit with R=5K Ω and C= 4μF. The maximum output voltage is?

a) 0.2 volt
b) 2.0 volts
c) 10.0 volts
d) 50.0 volts

Q3) The transfer function of a linear system is the

a) Which has zeros in the right halfs-plane
b) Which has zeros only in the left halfs-plane
c) Which has poles in the right halfs-plane
d) Which has poles in the left halfs-plane

Q4) The amplitude spectrum of a Gaussian pulse is

a) Uniform
b) A sine function
c) Gaussian
d) An impulse function

Q5)A Hilbert transformer is a

a) Non- linear system
b) Non- causal system
c) Time varying system
d) Low- pass system

Twenty Questions: Marks = 3 x 20 = 60 **60 Marks**

Q1)The minimized form of the logical expression

(A'B'C' + A'BC' + A'BC+ ABC') is

a) A'C'+BC'+A'B
b) AC'+B'C+A'B
c) A'C+B'C+A'B
d) AC'+B'C+AB'

Q2) An analog signal is band-limited to 4KHz. Sampled at the Nyquist rate and the samples are quantized into 4 levels. The quantized levels are assumed to be independent and equally probable

a) 1 bit/sec
b) 2 bit/sec
c) 3 bit/sec
d) 4 bit/sec

Q3) A system has 14 poles and 2 zeros. Its high frequency asymptote in its magnitude plot having a slope of

a) -40dB/ decade
b) -240dB/ decade
c) -280dB/ decade
d) -320dB/ decade

Q4) In a uniformly doped abrupt p-n junction the doping level of the n-side is 4 times the doping level of the p-side. The ratio of the depletion layer width of the n-side versus the p-side is

a) 0.25
b) 0.5
c) 1.0
d) 2.0

Q5)Signals A, B, C, D and D' are available. Using a single 8-to1 multiplexer and no other gate, implement the Boolean function

f(A,B,C,D) = B.C + A.B.D' + A'.C'.D