Department of Electronics and Electrical Engineering (EEE)  
Indian Institute of Technology (IIT) Guwahati  

DATES FOR MTECH ADMISSION  
SUNDAY, 25th May 2014 to TUESDAY, 27th May 2014  

The Dept. of EEE, IIT Guwahati offers MTech Programs in the following specializations:  

1. Signal Processing,  
2. VLSI  
3. Communication Engineering &  
4. Power and Control.  

The Written Test and Interview / Counselling for selecting candidates for possible admission to 2014-15 academic session is scheduled from SUNDAY, 25th May 2014 to TUESDAY, 27th May 2014.  

The list of shortlisted candidates will be announced shortly. The prospective candidates are hereby informed to plan the trip to reach IIT Guwahati latest by SATURDAY, 24th May 2014 and leave IIT Guwahati after TUESDAY, 27th May 2014.  

The accommodation for shortlisted MALE Candidates will be arranged in the institute BOYS hostel from 24th Afternoon to 27th Forenoon May 2014.  

The accommodation for shortlisted FEMALE Candidates will be arranged in the institute GIRLS hostel from 24th Afternoon to 27th Forenoon May 2014.  

The details of accommodation will be announced later.  

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Indian Institute of Technology (IIT) Guwahati

PATTERN of MTech Admission Written Test Question Paper for Non-Regular Categories (Sponsored / Part-Time/ Project taff and IIT Degree Holder with Min CPI of 7.0)

Duration of the examination: 60 Minutes

Section 1 is compulsory and any two other sections are to be attempted from the remaining sections.

Total Marks: 60 (20 marks for section 1 and 20 marks each for the remaining sections. There is negative marking for wrong answer.)

Use of calculators is allowed. (Candidates carrying mobile phones must keep them in switched off mode during examination)

1. The question paper will have the following SIX parts:
   1. Mathematics (MA): 20 marks
   2. Signal Processing: 20 marks
   3. Communication: 20 marks
   4. Control and Instrumentation: 20 Marks
   5. VLSI: 20 marks
   6. Power: 20 marks

2. All the questions are of multiple choice type and / or fill in the blanks type and / or subjective type.

3. Section 1 is compulsory and any two other sections are to be attempted from the remaining sections.

4. Detailed syllabus and model questions will be announced shortly.

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Syllabus for Engineering Mathematics

**Linear Algebra:** algebra of matrices, system of linear equations, eigenvalues and eigenvectors, diagonalization of matrices.

**Calculus:** functions of single variable, functions of two variables, partial derivatives, maxima and minima, sequence and series.

**Complex Analysis:** analytic functions, Cauchy-Riemann equations, Cauchy’s integral formula, Taylor’s and Laurent’ series, Residue theorem.

**Vector Calculus:** gradient, divergence and curl, Stokes, Gauss and Green’s theorems.

**Differential Equations:** first order equations, second order linear differential equations, partial differential equations, separation of variables method.

**Probability and Statistics:** probability, conditional probability, Bayes theorem, random variables, discrete and continuous distributions.

**Numerical Methods:** L-U decomposition, Gauss-Jordan and Gauss-Seidel Methods, Newton-Raphson method, Trapezoidal rule, Simpson’s rule.

Classification of Signals and Systems: Signals, systems and signal processing; Classification of signals; Properties of systems; Discrete time signals and systems; analysis of LTI systems; Impulse response; Convolution.

Transforms: Definitions and properties of (a) continuous and discrete time Fourier series and transform; (b) Laplace transform and its inverse; (c) z-transform and its inverse; Analysis of discrete time systems in the z-domain.

Sampling and Reconstruction of Signals: Ideal sampling and reconstruction of continuous time signals; Discrete time processing of continuous time signals; analog to digital and digital to analog converters; Sampling and reconstruction of continuous time bandpass signals; Sampling of discrete time signals; Oversampling A/D and D/A converters.

Discrete Fourier Transform (DFT): Frequency domain sampling; Properties of DFT; Linear filtering methods based on DFT; Frequency analysis of signals using DFT; Efficient computation of DFT – Fast Fourier transform, Decimation in time (DIT) and Decimation in Frequency (DIF); Application of FFT algorithms, Linear filtering approach to computation of DFT, Quantization effects in the computation of DFT.


Implementation of Discrete Time Systems: Structure for the realization of discrete time systems; Direct, cascade and parallel relations for FIR and IIR Systems.


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Electronic Devices:


Analog Circuits:


Digital circuits:

Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor(8085): architecture, programming, memory and I/O interfacing.
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Syllabus for Control and Instrumentation

Control Systems
Basic control system components: block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems. Transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis and design: Routh Hurwitz criterion, root loci, principle of argument and Nyquist stability criterion, Nyquist and Bode plots. Control system compensators: elements of lead and lag compensation, elements of Proportional Integral Derivative (PID) control.


Books:

Instrumentation
Static and dynamic characteristics of measurement systems, first order and second order systems, error analysis; electromechanical indicating instruments: ac/dc current and voltage meters, loading effect, extension of instrument ranges, measurement of power and energy; instrument transformers. AC & DC bridges; resistive, capacitive, inductive transducers, and their signal conditioning; digital voltmeter and multimeter, oscilloscope, frequency counter; analog-to-digital and digital-to-analog converters.

Books:
Random signal analysis: probability, random variables, probability density function, autocorrelation, power spectral density

Analog Communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions.

Pulse modulation schemes: Sampling theorem and reconstruction, quantisation PAM, PWM, PCM PPM.

Digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes.

Information theory and coding: Measure of information, entropy, source coding theorem, channel coding theorem.

Wireless communication: TDMA, FDMA and CDMA and GSM.

Microwave Engineering: Transmission lines, Waveguides, Microwave Networks, Microwave Resonators


Reference:
3. DM Pozar, Microwave Engineering, John Wiley & Sons, 2005
1. Electric Circuits and Networks

Nodal and mesh analysis. Network theorems: Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, Star-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks, three phase circuits.

2. Electrical Machines

Single phase transformer -equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers connections, parallel operation; auto-transformer; energy conversion principles; DC machines -types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines - performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors.

3. Power Systems

Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; perunit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of overcurrent, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

4. Power Electronics and Drives

Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs -static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters -fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.

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