University of Kashmir

Entrance Examination Syllabus for M. Tech Degree Programme in Mechanical Eng.

Unit 1 {4 Marks}

Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

Unit 2 {4 Marks}

Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors.

Unit 3 {4 Marks}

Calculus: limits, continuity and differentiability, mean value theorems, evaluation of definite and improper integrals, partial derivatives, total derivative, Taylor series, maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems.

Unit 4 {4 Marks}

Differential equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

Unit 5 {4 Marks}

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.

Complex variables: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series.

Unit 6 {4 Marks}

Probability and Statistics: Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.

Unit 7 {4 Marks}

Engineering Mechanics: Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions.

Unit 8 {4 Marks}

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio, Mohr's circle for plane stress and plane strain, thin cylinders, shear force and bending moment diagrams, bending and shear stresses, deflection of beams, torsion of circular shafts, Euler's theory of columns, energy methods, thermal stresses, strain gauges and rosettes.

Unit 9 {4 Marks}

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms, dynamic analysis of linkages, cams, gears and gear trains, flywheels and governors, balancing of reciprocating and rotating masses, gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping, vibration isolation, resonance; critical speeds of shafts.

Unit 10 {4 Marks}

Machine Design: Design for static and dynamic loading, failure theories, fatigue strength and the S-N diagram, principles of the design of machine elements such as bolted, riveted and welded joints, shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Unit 11 {4 Marks}

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy, fluid acceleration, differential equations of continuity and momentum, Bernoulli's equation, dimensional analysis, viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.

Unit 12 {4 Marks}

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, heat transfer through fins, unsteady heat conduction, lumped parameter system, Heisler's charts, thermal boundary layer, dimensionless parameters heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence, heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Unit 13 {4 Marks}

Thermodynamics: Thermodynamic systems and processes, properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes, second law of thermodynamics, thermodynamic property charts and tables, availability and irreversibility, thermodynamic relations.

Applications: *Power Engineering*: Air and gas compressors; vapor and gas power cycles, concepts of regeneration and reheat. *I.C. Engines*: Air-standard Otto, Diesel and dual cycles. *Refrigeration and air-conditioning*: Vapor and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. *Turbomachinery*: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Unit 14 {4 Marks}

Manufacturing Technology: Engineering Materials, Structure and properties of engineering materials, Crystal systems, crystallographic directions and planes, imperfections in solids, phase diagrams, heat treatment, Casting, Forming and Joining Processes, Fundamentals of hot and cold working processes, powder metallurgy, welding, brazing, soldering and adhesive bonding. Mechanics of machining, basic machine tools, tool life and wear, economics of machining, nontraditional machining processes, jigs and fixtures.

Limits, fits and tolerances, form and finish measurement, tolerance analysis in manufacturing and assembly. Basic concept of CAD/CAM.

Unit 15 {4 Marks}

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning, Inventory Control, Deterministic models, safety stock inventory control systems. Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Entrance Test Syllabus for M.Tech (Embedded Systems and Solutions)
Academic Session-2018

Unit 1: Linear Algebra and Calculus

Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness.

Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series.

Unit 2: Differential Equations and Vector Analysis

Differential Equations: First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems.

Vector Analysis: Vectors in plane and space, vector operations, gradient, divergence and curl, Gauss's, Green's and Stoke's theorems.

Unit 3: Complex Analysis, Numerical Methods and Probability

Complex Analysis: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem.

Numerical Methods: Solution of nonlinear equations, single and multi-step methods for differential equations, convergence criteria.

Probability and Statistics: Mean, median, mode and standard deviation; combinatorial probability, probability distribution functions - binomial, Poisson, exponential and normal; Joint and conditional probability; Correlation and regression analysis.

Unit 4: Network Analysis

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.

Unit 5: Signals and Systems

Introduction to 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

nd zeros, parallel and cascade structure, frequency response, group delay, phase delay, gital filter design techniques.

Unit 6: Semiconductor Materials and 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.

Unit 7: Analog Electronics

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 op-amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation.

Unit 8: Digital Electronics

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;

Unit 9: Microprocessor and Microcontroller

Introduction to 8-bit microprocessor (8085): 8085 Microprocessor Architecture, Address, Data and Control Buses. 8085 Pin functions, 8085 Instruction Set, Instructions and Data Formats, 8085 Interrupts, Programming, Stacks and Subroutines. I/O devices, Memory and I/O operations. Programmable Interrupt Controller 8259A, Programmable Peripheral Interface 8255A. Interfacing Concepts, Interfacing 8155, 8255, 8279, 8253, 8257, 8259,8251 with 8085 Microprocessor. Introduction to 8051 Microcontrollers Architecture, Features, Pin layout, addressing modes, accessing memory using various addressing modes.

Unit 10: Control System

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.

Unit 11: Analog Communication System

Random processes: autocorrelation and power spectral density, properties of white noise,

tering of random signals through LTI systems; Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers, circuits for analog communications; Information theory: entropy, mutual information and channel capacity theorem.

Unit 12: Digital Communication System

Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK).Fundamentals of error correction, Hamming codes; Electrostatics; Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters. Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays.

Unit 13: Computer Networks

Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls. Basics of TDMA, FDMA and CDMA.

Unit 14: Computer Organization and Architecture

Memory hierarchy, types and characteristics, Primary Memory-Types, Working, Cache Memory- Mapping Schemes, Replacement Policies; I/O interface (interrupt and DMA mode). Machine instructions and addressing modes. ALU, data-path and control unit. Introduction to Parallel Processing.Instruction pipelining. Scalar Data types: Sign Magnitude, One's and Two's Complement Representation of Integers. Integer Arithmetic, Floating Point Arithmetic. Booth's Algorithm and Hardware Implementation.

Unit 15: Introduction to Programming

Introduction of High-level Proramming Language, Introduction of data in C. Operators and its precedence, Various data types in C, Storage classes in C, Decision-making and forming loop in program, Handling character, Arrays in C, Structure and Union, User defined function, Pointers in C, Advanced pointer. Pointer to structures, pointer to functions, Dynamic data structure, file handling in C, Command line argument, Graphics-video modes, video adapters, Drawing various objects on screen, Interfacing to external hardware via serial/parallel port using C, Applying C to electronic circuit Problems.

Note: Four multiple choice questions will be set from each of the above units. Each question shall carry one mark.

University of Kashmir

Entrance Examination Syllabus for M. Tech Degree Programme in Electronics & Comm Eng.

Unit 1 [4 Marks]

Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

Unit 2 [4 Marks]

Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness.

Unit 3 [4 Marks]

Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series.

Unit 4 [4 Marks]

Differential Equations: First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems.

Unit 5 [4 Marks]

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.

Unit 6 [4 Marks]

Numerical Methods: Solution of nonlinear equations, single and multi-step methods for differential equations, convergence criteria.

Unit 7 [4 Marks]

Probability and Statistics: Mean, median, mode and standard deviation; combinatorial probability, probability distribution functions - binomial, Poisson, exponential and normal; Joint and conditional probability; Correlation and regression analysis.

Unit 8 [4 Marks]

Networks: 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.

Unit 9 [4 Marks]

Signals and Systems: 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.

Unit 10 [4 Marks]

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.

Unit 11 [4 Marks]

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 op-amp configurations; Function generators, waveshaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation.

Unit 12 [4 Marks]

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.

Unit 13 [4 Marks]

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 laglead compensation; State variable model and solution of state equation of LTI systems.

Unit 14 [4 Marks]

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.

Unit 15 [4 Marks]

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, Sparameters, 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.

Department of Computer Sciences

University of Kashmir

Entrance Examination Syllabus for M. Tech 2018

***Note*:**

The main objective of this paper is to assess the computer science and engineering background knowledge of candidates who want to pursue M. Tech degree programme. There shall be sixty questions, each carrying one mark. Weightage to be given to each section is given within parenthesis. Paper setters are required to set the required number of multiple choice type questions with only one correct or most appropriate answer, separately for each section, giving uniform representation to the whole syllabus contained therein.

Unit 1 **[4 Marks]**

Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

Unit 2 **[4 Marks]**

Numerical Ability: Numerical computation, numerical estimation, numerical reasoning and data interpretation.

Unit 3 **[4 Marks]**

Discrete Mathematics: Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Groups. Graphs: connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions.

Unit 4

Linear Algebra: **[4 Marks]**

Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition.

Unit 5

Calculus: **[4 Marks]**

Limits, continuity and differentiability. Maxima and minima. Mean value theorem. Integration.

Unit 6

Probability: **[4 Marks]**

Random variables. Uniform, normal, exponential, poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.

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Unit 7

Digital Logic : **[4 Marks]**

Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

Unit 8

Computer Organization and Architecture: **[4 Marks]**

Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Unit 9

Programming and Data Structures **[4 Marks]**

Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Unit 10

Algorithms : **[4 Marks]**

Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph search, minimum spanning trees, shortest paths.

Unit 11

Theory of Computation : **[4 Marks]**

Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and contex-free languages, pumping lemma. Turing machines and undecidability.

Unit12

Compiler Design: **[4 Marks]**

Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

Unit 13

Operating System : **[4 Marks]**

Processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems.

Unit 14

Databases : **[4 Marks]**

ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

18/11/17