الجامعة التكنولوجية

قسم هندسة السيطرة والنظم

مواد الامتحان التنافسي للعام الدراسي (2021-2022)

تخصص ماجستير هندسة الميكاترونكس

ت	اسم المادة	تفاصيل المفردات
1	Mechanical Design (مرحلة رابعة)	**1. Variable stresses and Design Criteria** **2. Spur Gear Design** **3. Power Screws design**
2	Computer Control (مرحلة رابعة)	**1. Sampled Data Control Systems** Sampling and reconstruction, properties of sampled signal, ideal Sampler, Z.O.H. **2. Analysis of Discrete Control System** Open-loop system, closed-loop system, system time-response, steady state error analysis, mapping S- plane /Z-plane. **3. Stability Analysis** Bilinear transformation, Z into W, the Routh-Hurwitz criterion, and Jury's stability test. **4. Design of Digital Controllers** Direct design controller, dead-beat controller, PID controller, Design and realization, response between sampling instants, discrete Time equivalent controller, Root locus, Modified Z- transform. **5. Time -Domain Analysis.** Impulse Response and step response for LTI processors (systems). Digital convolution. Difference equations. **6. Frequency-Domain Analysis (I).** Discrete Fourier Transform (DFT), DFT for periodic sequences, DFT for aperiodic digital sequence, DFT properties. Fast Fourier Transform (FFT). Frequency Response of LTI processor. **7. Frequency –Domain Analysis the Z-transform.** Definition and properties of the Z-transform. Z-plane poles and Zeros. **8. Design of Recursive digital filter (IIR)** Simple design based on Z-plane poles and zeros. Filters derived from analog designs. Frequency sampling filters.
3	Intelligent Control Systems (مرحلة رابعة)	**1. Neural networks (NNs):** - Artificial Neuron Types of Activation functions types of NNs (Feed-forward, Feedback, Supervised and

Unsupervised), and types of recall. - Learning Algorithms: Hebbian, perceptron and delta learning rules. - Generalized delta learning rule (Error back propagation algorithm for single and multiple layers. **2. Fuzzy Logic (FL):** - Fuzzy concepts, Fuzzy sets, and Fuzzy operations. -Fuzzification, Inference Engine, Rule-Base, and defuzzification - Fuzzy Logic Control (FCL). **3. Binary Genetic Algorithm (GA).** -Elements of GA, Genetic Operators, Initialization, Coding, Fitness Function, Selection, Crossover (Mating), and Mutation		
1. Introduction to Industrial Robot Manipulator - Robotics, - Classification of robots, - advantages and disadvantages of robots, - robot components, - anatomy of a robot, - robot degrees of freedom, - robot Coordinates, - robot Reference Frames, - robot languages, - world Reference Frame, - Joint Reference Frame, - Tool Reference Frame. **2. Robot Kinematics** - Matrix Representation of A point in space, - Representation a Vector in space, - Representation of the reference frame at the origin, - Representation of A Frame in space relative to the reference frame, - Representation of a Rigid Body, - Homogeneous Transformation matrices, - Representation of Transformation: pure Translation, Pure - Rotation combined Transformations,	Robotics (مرحلة رابعة)	4

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- Robot Arm Kinematics, - Manipulator parameters, - The Denavit-Hartenberg (D-H) Representation, Arm Matrix. **3.Robot Inverse Kinematics** - Inverse Kinematics (Geometric Approach) - Two-Link Planar Robot - Articulated Configuration **4.Robot Trajectory planning** - Path Vs Trajectory planning, - Joint-Space Vs. Cartesian-space Descriptions, - Basics of Trajectory planning, - Joint–space Trajectory planning methods, - third-order polynomial Trajectory planning,		
1. Linear algebra and Matrices - Vector, Solution of linear equations, Matrices **2. Ordinary differential equations** - Series solution to ODE (power series solution, Legendre polynomial, Frobenius solution and Bessel's function) and Partial differential Equations. **3. Complex Analysis** **4. Numerical Analysis**	Mathematics (II) (مرحلة ثالثة)	5
1. Signal flow graph and Mason's formula. **2. Transient Response Analysis.** **3. Routh – stability criterion.** **4. Root locus design of lead, lag, and lag-lead compensator.** **5. PID controller design.** **6. Bode plot.** **7. Nyquist stability.** **8. Describing function techniques.** **9. Phase plane method.**	Control (مرحلة ثالثة)	6
1. Introduction to OP–Amp - Analysis of Typical 741 OP–Amp with Negative Feedback, Partial OP–Amp, Circuit, Offset Voltages, Compensation, Drift, I/P Bias Current, CMRR, Data Sheets and Characteristics, Frequency Response, Slew Rate.	Electronics (II)and Microprocessors (مرحلة ثالثة)	7

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تخصص ماجستير هندسة الميكاترونكس

2. Linear Application - DC and AC Amplifiers, Inverting & Non-inverting Amplifiers, Summer, Integrator, Differentiator, Instrumentation Amplifier Voltage to Current & Current to Voltage Converters, Dual Phase Amplifiers, Electronic Analog Computation. **3. Internal Architecture of the 8086 Mp.** **4. External Architecture of the 8086 Mp.** **5. Addressing Modes.** **6. Instruction Set.** **7. Stack.** **8. Interfacing with 8255**		
1. Particle Kinematics - [Continuous Motion, Curvilinear Motion: Rectangular, Force & Acceleration" Equations of Motion in Rectangular", Work & Energy], **2. Rigid Body Kinematics** - [Relative Motion Acceleration Analysis, Force & Acceleration, Kinetic Energy, Work by a Force, Work by a Couple Principle of Work & Energy]. **3. Vibration** - Free Vibration of Single DOF Systems, Harmonically Excited Vibration, Vibration under General Forcing Conditions, Two DOF Systems, Determination of Natural Frequencies and Mode Shapes, Vibration Control, Vibration Measurement and Applications]	Dynamic (مرحلة ثالثة)	8
1. Bipolar Junction Transistor (BJT) - Construction, Operation, Characteristics, Configuration (C.E, C.B, C.C), Ratings. **2. D.C. Biasing and Thermal Stability** - Biasing Techniques, Stability Factors, Effect of Temperature. **3. Small Signal Analysis of BJT and FET Amplifiers** - H-parameters Mode, re-model, Equivalent Circuit, Voltage Gain, Current Gain, Input Impedance, Output Impedance. **4. Field Effect Transistor (FET)**	Electronics (I) (مرحلة ثانية)	9

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تخصص ماجستير هندسة الميكاترونكس

- Construction, Types, Characteristics, Biasing and D.C. Analysis. **5. FET Amplifiers** - A.C. Analysis of Common Source, Common Drain, Common Gate Amplifiers.		
1. Calculus - limit and continuity, Differentiation, Integration, Series and sequence **2. Partial derivative.** **3. Vector valued function.** **4. Double integral.** **5. Fourier series and Laplace transform.** **6- Ordinary differential equations, first order, linear set of equations**	Mathematics (I) (مرحلة أولى + مرحلة ثانية)	10