الجامعة التكنولوجية

قسم هندسة السيطرة والنظم

مواد الامتحان التنافسي للعام الدراسي (2024-2025)

تخصص ماجستير هندسة السيطرة

ت	اسم المادة	تفاصيل المفردات
1	Advanced Control Theory (المرحلة الرابعة)	**1. System Modes and Modes Decomposition:** Eigen-values and Eigen-vectors, Diagonalization of (n×n) Matrix, Diagonal Jordan, Controllable Canonical Form, Observable Canonical Form, Decomposition of Transfer Function. **2. Solution of Homogeneous and Non-Homogeneous System:** State transition matrix, Solution of time-invariant state-space equation, Cayley-Hamilton theorem, Sylvester Expansion theorem, Solution of time-varying state equation. **3. Controllability and Observability of Continuous System.** **4. Stability in Sense of Liapynov.** **5. Pole-Placement Using State Feedback Design.**
2	Computer Control (المرحلة الرابعة)	**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.

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تخصص ماجستير هندسة السيطرة

1. Model Reference Adaptive Control. **2. Self-Tuning Regulator.** **3. Gain Scheduling.**	Adaptive Control (المرحلة الرابعة)	3
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	Intelligent Control Systems (المرحلة الرابعة)	4
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** a) 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 Transformations: pure translation, pure rotation combined transformations, b) 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.	Robotics المرحلة الرابعة	5

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تخصص ماجستير هندسة السيطرة

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) (المرحلة الثالثة)	6
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 (المرحلة الثالثة)	7
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. **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. Microprocessors:** a) Internal Architecture of the 8086 Mp. b) External Architecture of the 8086 Mp. c) Addressing Modes. d) Instruction Set. e) Stack. f)Interfacing with 8255	Electronics (II) and Microprocessors (المرحلة الثالثة)	8
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:**	Mathematics (I) (المرحلة الأولى) (المرحلة الثانية)	9

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تخصص ماجستير هندسة السيطرة

first order, linear set of equations		
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):** Construction, Types, Characteristics, Biasing and D.C. Analysis. **5. FET Amplifiers:** A.C. Analysis of Common Source, Common Drain, Common Gate Amplifiers.	Electronics (I) (المرحلة الثانية)	10