الجامعة التكنولوجية

قسم هندسة السيطرة والنظم

مواد الامتحان التنافسي للعام الدراسي (2020–2021)

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.

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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.		
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,	Robotics المرحلة الرابعة	5

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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.		
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	Electronics (II) and Microprocessors المرحلة الثالثة	8

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تخصص ماجستير هندسة السيطرة

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		
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) المرحلة الأولى المرحلة الثانية	9
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