**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification. |

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| Baghdad University | 1. Teaching Institution |
| College of Engineering/Department of Electrical Engineering | 2. University Department/Centre |
| Control Engineering II | 3. Course title/code |
| Electrical Engineering | 4. Programme (s) to which it contributes |
| Internal | 5. Modes of Attendance offered |
| Fourth Year Class/ 2014-2015 | 6. Semester/Year |
| 60 | 7. Number of hours tuition (total) |
| 2014 | 8. Date of production/revision of this specification |
| 9. Aims of the Course | |
| To design a compensators, model and analyze the control system using state-space techniques, and model and analyze the sampled data control system using state-space techniques. | |
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| 10· Learning Outcomes, Teaching ,Learning and Assessment Method |
| 1. Knowledge and Understanding   A1. Understanding lecture notes and solving the homework problems.  A2. Understanding the practical control systems requirements from the modeling, analysis and design of a general systems based on lecture notes. |
| B. Subject-specific skills  B1. Reading some useful reference books related to control system modeling, analysis and design.  B2. Solving a specific practical problems.  B3. Find out online solution for a given questions during lecture time. |
| C. Thinking Skills  C1. Solving a practical problems related to control systems design. |
| Teaching and Learning Methods |
| Lecturing & class discussions |
| Assessment methods |
| Comprehensive exams, exams, assignments and seminars |

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| D. General and Transferable Skills (other skills relevant to employability and personal development)  D1. Solving an assignments.  D2. Preparing and Presenting a seminars. |

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| 11. Course Structure | | | | | |
| Assessment Method | Teaching  Method | Unit/Module or Topic Title | ILOs | Hours | Week |
| Exam | Lecturing, Discussions & Exercises | Design of Lead, and Lag compensators in frequency domain using Bode diagram. |  | 3 | 1 |
| Exam | Lecturing, Discussions & Exercises | Design of Lead-Lag compensators in frequency domain using Bode diagram. |  | 3 | 2 |
|  |  | Exam |  | 3 | 3 |
| Exam | Lecturing, Discussions & Exercises | Design of P, PI, PD and PID controllers. Zeigler-Nichols method of tuning PID controllers. |  | 3 | 4 |
| Exam | Lecturing, Discussions & Exercises | Introduction to nonlinear systems, Types of nonlinearities, describing functions, and describing function analysis of nonlinear control systems. |  | 3 | 5 |
|  |  | Seminar 1 |  | 3 | 6 |
| Exam | Lecturing, Discussions & Exercises | State variable representation of continuous time systems |  | 3 | 7 |
| Exam | Lecturing, Discussions & Exercises | Transfer function from the state variable model and state variable model from transfer function |  | 3 | 8 |
| Exam | Lecturing, Discussions & Exercises | Bush or companion form, controllable canonical form , and observable canonical form |  | 3 | 9 |
| Exam | Lecturing, Discussions & Exercises | Jordan canonical form, diagonalization, and state diagram. |  | 3 | 10 |
|  |  | Exam |  | 3 | 11 |
| Exam | Lecturing, Discussions & Exercises | Solution of linear time invariant state equation, state transition matrix, STM properties, computation of STM by Laplace, state transition matrix and Cayley Hamilton theorem. |  | 3 | 12 |
|  |  | Mid-Year Break |  |  | 13 |
|  |  | Comp. Exam 1 |  | 3 | 14 |
| Exam | Lecturing, Discussions & Exercises | Response of homogeneous and non-homogeneous systems. |  | 3 | 15 |
| Exam | Lecturing, Discussions & Exercises | Tests for controllability and observability for continuous time systems. |  | 3 | 16 |
| Exam | Lecturing, Discussions & Exercises | Time varying case, minimum energy control, time invariant case, and principle of duality. |  | 3 | 17 |
|  |  | Exam |  | 3 | 18 |
| Exam | Lecturing, Discussions & Exercises | Digital computer control system applications, sampled-data systems, sampling process- data reconstruction, hold circuits-Zero and first order hold, and review of z- transforms and inverse z- transforms. |  | 3 | 19 |
| Exam | Lecturing, Discussions & Exercises | Pulse transfer function, pulse transfer function with dead time, system time response, and realization of pulse transfer functions. |  | 3 | 20 |
| Exam | Lecturing, Discussions & Exercises | Performance of a sampled-data. |  | 3 | 21 |
|  |  | Exam |  | 3 | 22 |
| Exam | Lecturing, Discussions & Exercises | The root locus of digital control systems. |  | 3 | 23 |
| Exam | Lecturing, Discussions & Exercises | State space representation of discrete time systems, pulse transfer function matrix, and solving discrete time state space equations |  | 3 | 24 |
|  |  | Seminar 2 |  | 3 | 25 |
| Exam | Lecturing, Discussions & Exercises | State transition matrix and its properties, methods for computation of state transition matrix, and discretization of continuous time state – space equations. |  | 3 | 26 |
|  |  | Concepts of controllability and observability, tests for controllability and observability. |  | 3 | 27 |
|  |  | Comp. Exam 2 |  | 3 | 28 |

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| 12. Infrastructure | |
| 1. K. Ogata , *Modern Control Engineering,* Prentice Hall.  2. K. Ogata, “Discrete-time Control Systems”, Prentice-Hall. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER |
| The students should improve their skills in MATLAB simulation environments. | Special requirements (include for example workshops, periodicals, IT software, websites) |
| None | Community-based facilities  (include for example, guest  Lectures , internship , field studies) |

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| 13. Admissions | |
| ---------- | Pre-requisites |
| 25 | Minimum number of students |
| 30 | Maximum number of students |