Computer and Control Engineering

A-Thesis Track
The plan studying (33) Credits Hours as follows:

1-OBLIGATORY COURSES FOR SPECIALIZATION (9- credit hours)

No	code	course	LT	CR
1	EL501	English Technical Writing	3	0
2	ES501	Advanced Engineering Mathematics	3	3
3	EE524	Introduction to Automata Theory	3	3
4	EE525	Random Variables and Stochastic Processes	3	3

2-ELECTIVE COURSES: Studying (18 credit hours) from the following

No	code	course	LT	CR
1	EE 526	Discrete Time and Computer Control	3	3
2	EE 527	Microprocessors and Applications	3	3
3	EE 528	Optimal Control Theory	3	3
4	EE 529	System Identification	3	3
5	EE 530	Computer Organization And Networks	3	3
6	EE 531	Computer Simulation	3	3
7	EE 532	Advanced Computer Applications	3	3
8	EE 535	Digital System Design With LSI Bit Slice Logic	3	3
	EE 534	Advanced Artificial Intelligence	3	3
9	EE 536	Artificial Intelligence	3	3
10	EE 537	Advanced Digital Image Processing	3	3
11	EE590	Independent Study	3	3

3. Dissertation: (6) Credit hours<u>EE599</u>

B-Comprehensive Exam Track
The plan studying (33) Credits Hours as follows:

1-**OBLIGATORY COURSES FOR SPECIALIZATION (15- credit hours**

No	code	course	LT	CR
1	EL501	English Technical Writing	3	0
2	ES501	Advanced Engineering Mathematics	3	3
3	EE524	Introduction to Automata Theory	3	3
4	EE525	Random Variables and Stochastic Processes	3	3
5	EE 526	Discrete Time and Computer Control	3	3
6	EE 536	Artificial Intelligence	**3**	**3**

2-ELECTIVE COURSES: Studying (18 credit hours) from the following

No	**code**	**course**	**LT**	**CR**
1	EE 527	Microprocessors and Applications	**3**	**3**
2	EE 528	Optimal Control Theory	**3**	**3**
3	EE 529	System Identification	**3**	**3**
4	EE 530	Computer Organization And Networks	**3**	**3**
5	EE 531	Computer Simulation	**3**	**3**
6	EE 532	Advanced Computer Applications	**3**	**3**
7	EE 535	Digital System Design With LSI Bit Slice Logic	**3**	**3**
8	EE 537	Advanced Digital Image Processing	**3**	**3**
9	EE590	Independent Study	3	3

3- Passing Comprehensive Exam after successful completion of all courses

EE 524 Introduction to Automata theory and formal Language

Preliminaries: strings, alphabets, and languages, graphs and trees, Finite automata and regular expressions: Concepts of automata, Finite state systems, Non deterministic finite automata, Regular expressions, Two way finite automata, Finite automata with outputs, Applications. Context free grammars*:* Context-free grammars, Derivation frees, Simplification of context- free grammar, Chomsky normal form, Greibach normal form. Pushdown Automata*:* Informal description, Definitions, Pushdown automata and context free languages. Turing machine: The Turing machine model, Techniques of Turing machine construction, Modification of Turing machines. The chomsky hierarchy and deterministic context-free languages: Regular grammars, Unrestricted grammars, Context-sensitive languages, Normal forms for DPD's, Closure of DCFL's under complementation, LR(0) grammars, LR(0) grammars and DPDA's, LR (K) grammars.

EE 525 Random Variable and Stochastic Processes

Probability, Definition and axioms, random experiment, probability. Conditional probability, Bayes theorem. combined experiment.Random Variable
One dimensional random variable, definition, examples, moments, characteristics function, trains of random variable, conditional characteristics N-dimensional random variable. Joint characteristic correlation, covariance, independence. Outcome, borefield, events, Independence. Extension to Stochastic Processes Notion of random function, statistics, stochastic processes, stationary, periodicity, second order stochastic processes, sampling, discrete random processes. Examples of stochastic processes Poisson process, telegraph process, normal process, white noise and its importance, Markov process, Applications, modulation: AM, FM, P AM. Mean square estimation: predication, Filtering spectral analysis (MAX. Entro*py method).*

EE 526 Discrete time and computer control systems

Introduction: Review of different representations of discrete systems(difference equation, state variable, and transfer function representations). Relationships between discrete systems, Z-transformation, and linear discrete-time systems. Analysis of discrete-time systems: Time domain approach, Data hold techniques, Open loop and closed loop sampled data systems. Discrete state analysis of computer control systems. Analysis of a digital process controller. Stability of discrete systems. Z-domain approach. Transfer function of a digital computer. Typical sampled-data systems. Stability analysis. Root locus technique. Design of discrete systems. Time-domain synthesis with minimum setting time. Controllability and observability. Regulator problem. Minimum energy control. Tracking test inputs. Engineering characteristics of computer control systems. Digital and shaft encoders. Data converts. Stepper motor. Computer methods in system studies. Numerical methods of simulating system dynamics. State transition method in simulation studies. Digital and analog computer simulation of digital systems. Hybrid computer techniques.

EE 528 Optimal Control Theory and Applications

Nonlinear optimal control of continuous-time systems. Minimum time and constrained input problems. Linear quadratic regulator. Optimal output-feedback. Optimal state estimation. Linear quadratic Gaussian design. Case studies.

EE 529 System Identification

Mathematical models of systems and relationships among them. Classical methods of system identification. Cost function and gradient techniques for system identification. Correlation function techniques. Identification by regression. System identification using stochastic approximation. Quasi-linearization approach to identification. Heuristic identification techniques.

EE 530 Computer Organization and design

Review of combinational and sequential logic design. Advanced concepts of sequential machines. Designing logic system using state machine. Implementation of micro-operation sequences using standard ICs. CPU organizations, buses. Microprocessors. Microprogram control. Memory organization, input/output, interrupts. DMA. Time sharing system. Paging. Segmenting.

EE 531 Computer Simulation

Introduction to models, simulation and computers. Simulation of continuous systems. Simulation of queuing systems. Simulation languages. Interactive simulation with minicomputers. High performance technique.

EE 532 Advanced Computer Applications

Basic analytical methods related to man-machine communication by voice and vision. Basic concepts of artificial intelligence and pattern recognition. Numerical control machines: robots, robotics systems, industrial robot, application overview. Computer graphics.

EE534 Advanced Artificial Intelligent Techniques

The aim of this module is to give you a comprehensive understanding of the role of artificial intelligence in control applications, and provide you with practical experience of using techniques such as fuzzy logic; linear

fuzzy logic control, Adaptive & identification using fuzzy logic, artificial neural network: direct & indirect, and evolutionary computing in engineering applications.

EE 536 Artificial Intelligence

Problems and Search: What is Artificial Intelligence, Problems, Problem Spaces, and Search, Heuristic Search Techniques. Knowledge Representation Formalisms: Logic representation, Rule- based representation, Structured representation. Advanced Topics, Planning, Connectionist Models, Expert Systems.

EE 537 Advanced Digital Image Processing

Digital Filters. Realization. Non-recursive Digital Filters. Recursive Digital filters. Non-recursive filter approximation. Design of 2-D, Infinite impulse response filter(IIR). Image Restoration. Neural Computing. Image Compression. Pattern Recognition.