**Flexible Manufacturing Systems, Automation in Manufacturing (MIEG 6452)**

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| **School of Mechanical & Industrial Engineering****Addis Ababa Institute of Technology****Addis Ababa University** |
| **Course Number** | MIEG 6452 |
| **Course Title** | Flexible Manufacturing Systems, Automation in Manufacturing |
| **Degree Program** | M.Sc in Mechanical Engineering (Manufacturing Engineering) |
| **Instructor** | Desalegn W. (PhD) |
| **Credit Hours:**  | 3 |
| **ESTC** | 7 |
| **Contact Hours** | 3 Lecture |
| **Course Objective** | * The course Flexible Manufacturing Systems enables students to understand and design flexibility of a manufacturing plant or an industry system for machine flexibility and routing flexibility. Machine flexibility focuses on ability to be changed to produce new product types, and ability to change the order of operations executed on a part. Routing flexibility focuses on the ability to use multiple machines to perform the same operation on a part, as well as the system’s ability to absorb large-scale changes, such as in volume, capacity, or capability.
* **Students study FMS aspects of:**
1. Work machines which are often using computerized machines,
2. Material handling system to optimize parts flow,
3. The central control computer which controls material movements and machine flow,
4. Flexible Manufacturing System (FMS) consisting of robots,
5. Computer-controlled Machines,
6. Numerical controlled machines (CNC),
7. Instrumentation devices,
8. Computers, sensors, and other stand-alone systems such as inspection machines
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| **Course Description** | * Flexible Manufacturing Systems (FMS) involve substituting machines capable of performing a wide and redefinable variety of tasks for machines dedicated to the performance of specific tasks.
* FMS can also be programmed to handle new products, thus extending the machines' life cycles.
* Thus they represent a change from "standardized goods produced by customized machines" to "customized goods produced by standardized machines".
* This course contains fundamental, new and updated materials in this field.
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| **Course Outline** | 1. **Introduction to Flexible Manufacturing Systems**: Definitions, Objectives of FMS, Basic components of FMS, Rigid versus flexible systems; Types of flexibility, Types of layouts in FMS, Benefits and Applications of FMS
2. **FLEXIBLE MANUFACTURING SYSTEMS**: Main systems of FMS; Sub-system of FMS (Technical system, Processing system, Tool management & supply);
3. **LEVELS OF FLEXIBILITY**: Flexible Manufacturing Module (FMM): NC Machines; Flexible Manufacturing (Assembly) Cell: Four FMMs and an AGV (automated guided vehicle); Flexible Manufacturing Group (FMG): Two FMCs, a FMM and two AGVs; Flexible Production Systems (FPS): A FMG and a FAC, two AGVs, an Automated Tool Storage, and an Automated Part/assembly Storage; Flexible Manufacturing Line (FML): multiple stations in a line layout and AGVs
4. **CNC Machines in FMS**
5. **Robotics in FMS**
6. **PERFORMANCE EVALUATION OF FMS**: Analytical models; Classical closed queuing network model; Data preparation
7. **EXPERT SYSTEM & FMS SIMULATION MODELS**: Expert system approach of FMS control; Simulation models of FMS
8. **SUPERVISORY CONTROL OF FMS**: Communication architecture; discrete event system; Petrinent models
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| **Pre-requisites** | None |
| **Semester** | II |
| **Method of Delivery** | * Lecture supported by tutorials
* Assignments and Projects.
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| **Evaluation**  | * Assignment = 20%
* Project work = 30%
* Final Exam = 50%
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| **Attendance Requirements** | * Minimum 75% attendance
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| **Semester Hours:** |  **48 Hours** |
| **Textbooks** | 1. Flexible Manufacturing Systems in Practice: Design: Analysis and Simulation (Manufacturing Engineering and Materials Processing); Joseph Talavage, Roger G. Hanman; ISBN-10: 0824777182, ISBN-13: 978-0824777180 |
| **References** | 1. Handbook of Flexible Manufacturing Systems; Edited by: Nand K. Jha; ISBN: 978-0-12-385310-3
2. Flexible Manufacturing System by H.K. Shivanand, M.M. Benal, V. Koti; New Age international
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