

## Advanced Manufacturing System

### First Semester

<u>Code</u>	<u>Subject</u>	<u>Hours/week</u>	<u>Units</u>
MOE 621	<u>Advanced mathematics</u>	<u>2</u>	<u>2</u>
MOE 641	<u>Advanced Manufacturing Process</u>	<u>2</u>	<u>2</u>
MOE 642	<u>Industrial Robotics and Automated Manufacturing</u>	<u>2</u>	<u>2</u>
MOE 643	<u>Advanced CAD/CAM</u>	<u>2</u>	<u>2</u>
MOE 644	<u>Computer Control Systems</u>	<u>2</u>	<u>2</u>
MOE 645	<u>Micro and Nano Systems Technology</u>	<u>2</u>	<u>2</u>
<b><u>Total</u></b>		<b><u>12</u></b>	<b><u>12</u></b>

- **MOE 621 Advanced Mathematics**

- Review of linear algebra, applications networks, structures and estimation .
- Lagrange multiplier.
- Laplace equation, boundary value problem.
- Minimum principles and calculus of variations.
- Fourier series, discrete Fourier transform ,convolution .
- Vector differential calculus.
- Legendre polynomials.
- Bessel equation and Bessel function.
- Stochastic process, spectral analysis , Markov chains , central limit theorem.
- Dynamical systems, linear and non-Linear systems , phase space dynamics, fixedpoints, limit cycles and attractors.

- **MOE 641 Advanced Manufacturing processes**

- Ultrasonic machining.
- Abrasive flow machining.
- Water jet cutting .
- Electro-chemical machining .
- Electrical discharge machining.
- plasma arc machining.
- Laser applications in Manufacturing processes.
- Rapid prototyping Surface properties of non-traditional processed materials.
- Surface properties of non-traditional processed materials

- **MOE 642 Industrial Robotics and Automated Manufacturing**

- Introduction to industrial robots .
- Building blocks of automation.
- Electrical, pneumatic and hydraulic components.
- Automated material handling systems.
- Simulation of automated systems.
- CNC machines.
- Automated barcode systems.
- Programming logic control(PLC).
- Industrial application of robots and mechanization of parts handling .
- End of arm tooling .
- Planning robots implementation.
- Industrial logic control systems and logic diagramming .
- Programming Programmable controllers.
- Work cell Programming.

- **MOE 643 Advance CAD/CAM**

- Introduction to CAD/CAM Hardware and software.
- graphics and product definition and uses of CAD/CAM standards (IGES, STEP, DXF)
- Aspects toward perfected CAD/CAM connectivity.
- Feature-based and feature-recognition CAD/CAM .
- Automated coding and classification .
- Computer-aided process planning (CAPP).
- Assembly and subassembly using CAD packages.
- Producibility and manufacturability.
- Mathematical bases of geometric modeling .
- User interfaces of CAD/CAM systems .
- CAD/CAM data exchange.
- KNOWLEDGE BASED Machining .
- Use of CAD packages (Master CAM, SurfCAM).

- **MOE 644 Computer Control System**

- Computer numerical Control and part Programming.
- Computer and CNC architecture.
- Logics and programmable logic controllers .
- Discrete Control system design .
- Command generation for motion Control.
- Actuators (DC, AC, and stepping motors).
- Motion Control system.

- **MOE 645 Micro and Nano System Technology**

- Introduction to micromachining and MEMS.
- MEMS fabrication .
- Micro and Nano sciences .
- Microscopic energy transport .
- MEMS devices, physics and design.
- Experimental mechanics of MEMS.
- Sensors-actuators and signal processing .
- Interfacial phenomena.
- Micro/Nano fluids.

## Second Semester

<u>Code</u>	<u>Subject</u>	<u>Hours/week</u>	<u>Units</u>
MOE 622	<u>Numerical Modeling and Simulation</u>	<u>2</u>	<u>2</u>
MOE 646	<u>Computer Integrated and Flexible Manufacturing Systems</u>	<u>2</u>	<u>2</u>
MOE 647	<u>Manufacturing Measurement and Intelligent Inspection Technology</u>	<u>2</u>	<u>2</u>
MOE 648	<u>Manufacturing Systems and Quality Management</u>	<u>2</u>	<u>2</u>
MOE 649	<u>Advanced Engineering Material</u>	<u>2</u>	<u>2</u>
MOE 6410	<u>Manufacturing Information and Data Systems</u>	<u>2</u>	<u>2</u>
	<u>طرائق كتابة البحوث</u>		
<b><u>Total</u></b>		<b><u>12</u></b>	<b><u>12</u></b>

- **MOE 622 Numerical Modeling and Simulation**

- Influence of process variables on manufacturing.
- Need of optimization of process parameters.
- Role of numerical modeling and simulation.
- Fundamentals of finite element method.
- Variational approach.
- Weighted residue.
- Material non-linearity.
- Application of FEM.
- Approach to modeling of manufacturing processes (Welding, Casting , forming, etc.).
- Major causes of errors.

- **MOE 646 Computer Integrated and Flexible manufacturing System**

- Product data exchange standards and virtual manufacturing.
- Variable selection in regression analysis.
- Criteria for regression models selection.
- Cross-validation, hypothesis testing and prediction regression modeling.
- Introduction to neural networks.

- Neural network modeling.
- Assembly line analysis.
- Group technology.
- Cellular and flexible manufacturing.
- Modeling and simulation of FMS and CIMS.
- Just-in-time manufacturing, lean production /enterprise, and agile manufacturing.
- Synchronous manufacturing and theory of constraints.
- Information systems and e- manufacturing.

- **MOE 647 Manufacturing Measurements and Intelligent Inspection Technology**

- Introduction to intelligent inspection methods.
- computer vision and image processing.
- Multiple line –scan camera web inspection systems.
- High speed color grading, discoloration detection systems.
- Multiple area-scan camera vision systems for non- contact gauging .
- Defect analysis and identification. Volume and surface area measurements.
- Near –IR imaging.
- Moisture measurements.
- Texture and surface measurements.
- Tracking using linear dynamic models.
- Pattern recognition;
- Design and build real –time high speed vision systems.

- **MOE 648 Manufacturing system and Quality Management**

- Production and operations Management.
- productivity, competitiveness and Decision making.
- Total quality Management.
- product and service design.
- Reliability.
- process selection and capacity planning.
- Linear programming.
- facilities layout.
- Design of work systems.
- Learning curves.

- Location planning.
- Transportation model.
- project management.

- **MOE 649 Advanced Engineering Materials**

- Introduction to physical properties of materials.
- properties and structures of composite materials.
- Ceramic materials.
- processing of ceramics, modeling, and chemical bonding.
- plastics, polymerization, and bond strength.
- Bonding position on near-polymerization mechanisms.
- High temperature materials.
- Advanced coatings.
- Industrial applications of composites and ceramics.
- Friction materials.
- Microelectronics and MEMS materials.
- Materials in energy systems.

**MOE 6410 Manufacturing Information and Data Systems**

- Introduction to information technology.
- Computer system.
- Database systems.
- product data system.
- process and facilities planning systems.
- production planning systems.
- Enterprise resource planning (ERP) systems.

- Manufacturing execution systems (MES).
- Warehouse management systems (WMS).
- Supervisory control and acquisition (SCADA) systems.
- Automation systems.
- systems integration.