Majmaah University

College of Engineering

Industrial Engineering

Course Description

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| **Industrial Operations Research I** | |
| ME 371 | **Code & No:** |
| 3(3-1-0) | **Credits:** |
| Math 107 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 8 | **Level:** |

**Module Description**

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| Introduction to Operations Research. Formulation of linear programming problems. Graphical solution. The Simplex algorithm. Duality and sensitivity analysis. Transportation and assignment problems. Integer and Goal programming. |

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|  | Module Aims |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Operations Research, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Be able to mathematically formulate different engineering problems, solve linear problems, and perform sensitivity analysis, * Understand the term "heuristic solutions" and show ability to use them in solving network problems (transportation, assignment, max. flow,. etc) * Be able to formulate and solve problems with interger variables using Integer-programming. * Be able to use Goal-programming | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | |
| Skills required for the use of mathematical modeling in solving various engineering problems. | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The analytical thinking skills. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

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| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Identify, formulate, and solve engineering problems. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Operations Research, Hamdy A. Taha, 6th Ed. Prentice Hall.
* Operations Research, Deterministic Optimization Models, Katta G. Murty, Prentice Hall, 1995.

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| **Quality Management** | |
| ME 372 | **Code & No:** |
| 3(3-1-0) | **Credits:** |
| STAT 101 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 8 | **Level:** |

**Module Description**

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| --- |
| Introduction to quality systems. Cost of quality. Total quality management. Quality systems and standards: six sigma and ISO. Reengineering. Statistical quality control: control charts for variables and attributes, process capability analysis, acceptance sampling plans. Quality function deployment. Quality circles. Quality loss functions. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Quality Management, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Gain knowledge of: Basic elements of a Quality Management System (QMS); International standards such as ISO 9000 and ISO 14001; Six Sigma; Structuring QMS; documentation; Strategic and competitive issues in QMS; Quality auditing and management reviews; * Become able to apply basic methods of statistical process control (SPC) as problem solving tools and methods for process capability analysis and statistical inferences * Understand different quality improvement tools (Quality function deployment. Quality circles. Quality loss functions). | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| Ability for team work. | |
| The skills necessary to develop a project or a business plan on a scientific and systematic basis. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

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**Outcomes**

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| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Function on multi-disciplinary teams. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Introduction to Statistical Quality Control, Douglas C. Montgomery, John Wiley & Sons, 2001
* Quality Planning & Analysis, J. M, Juran & F. M. Gryna, Mc GRAW-HILL International Editions, 1993

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| **Reliability** **& Maintenance Engineering** | |
| ME 373 | **Code & No:** |
| 2 (2-1-0) | **Credits:** |
| ME 101 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 8 | **Level:** |

**Module Description**

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| --- | --- | --- | --- |
| Maintenance systems. Maintenance operation and control. Preventive Maintenance: concepts, modeling, and analysis. Maintenance planning and scheduling. Maintenance material control. Computerized Maintenance Management Systems. Replacement studies. Case studies. | | | |
|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Reliability & Maintenance Engineering, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:  Understand types of maintenance plans, and features of good and effective maintenance planning and control system,  Be able to schedule maintenance work with the consideration of planning and control for maintenance material,  Be aware of Computerized Maintenance Management Systems.  Be able to carry out replacement studies. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools for engineering practice. | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| Ability for team work. | |
| The skills necessary to demonstrate cooperative planning and problem solving. | |
| The skills necessary to develop a project or a business plan on a scientific and systematic basis. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Function on multi-disciplinary teams. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Planning & Control of Maintenance Systems, Modeling and Analysis, Duffuaa, S O, Raouf, A & Campbell, J D, John Wiley & Sons, New York, 1999
* Strategies for Excellence in Maintenance Management, Campbell, J D, Productivity Press, Portlan, 1995

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| **Industrial Operations Research II** | |
| ME 474 | **Code & No:** |
| 3 (3-1-0) | **Credits:** |
| ME 371 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| --- | --- | --- | --- |
| Non-linear programming. Dynamic programming. Inventory models. Waiting line models. Markov analysis. Introduction to Game theory. Applications in industrial, service and public systems. | | | |
|  | | **Module Aims** | |
|  | | **Provide students with:** | |
| An understanding of the definition, necessary backgournd and importance of the subject of Stochastic Operations Research Models, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:  Extend the background in modeling and solving real-world industrial engineering problems. Comprehend: the Nonlinear programming and its applications, the dynamic programming and its applications,  To present an applied treatment of modelling, analysis and solution of probabilistic operations research problems: Inventory models, Markov analysis, Waiting line models and queuing theory  Understand Game Theory and its applications | | | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | | | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | | | |
| Skills required for the use of mathematical modeling in solving various engineering problems. | | | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | | | |
| The analytical thinking skills. | | | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | | | |
| Apply knowledge of mathematics, science, and engineering. | | |
| Identify, formulate, and solve engineering problems. | | |
| Understand the impact of engineering solutions in a global and societal context. | | |
| Recognize the need to engage in life-long learning. | | |
| Gain knowledge of contemporary issues. | | |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. | | |

**Textbooks and References**

* Introduction to Operations Research, Hillier and Lieberman, McGraw Hill, Singapore, 7e, 2001
* Operations Research: An Introduction, Hamdy A. Taha, Pearson Education, Singapore, 7e, 2002

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| **Computer Aided Design & Manufacturing** | |
| ME 475 | **Code & No:** |
| 3 (2-1-2) | **Credits:** |
| ME 212 – ME 323 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| --- | --- | --- | --- |
| Introduction to CAD/CAM; Computer  technology and CAD/CAM software and hardware; Geometric modeling and its  approaches; Geometric transformations; Viewing in 3D; Numerical control; Types of numerical control; Numerical control programming. | | | |
|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Computer Aided Design & Manufacturing, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:  Understand basic concepts of Computer Numerical Control (CNC) machines  Develop/compute the process plan of simple components (drawing, write the part program, and execute it on a model CNC machine,  Explain/use the working principles of different types of Robots and be able to write programs for them.  Explain the methods of Group Technology (GT) and develop some ability to design machine cells based on GT.  Explain the basic principles of CAPP and how CIMS work.  Explain the working principles of Flexible Manufacturing System (FMS) | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools necessary for engineering practice. | |
| Ability to design and conduct experiments, as well as to collect, analyze and interpret data. | |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in writing. | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design and conduct experiments, as well as to analyze and interpret data. |
| Design a system, component, or process to meet desired needs. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Mikell P. Groover, and Emory W. Zimmers, Jr.: "CAD/CAM: Computer-Aided Design and Manufacturing", Prentice Hall, Inc. 1990.

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| **Work Study Lab** | |
| ME 495 | **Code & No:** |
| 1 (0-0-2) | **Credits:** |
| ME 111 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| --- | --- | --- |
| Introduction to Work Study (WS). Productivity and WS. WS approaches. Basic procedure of method study involving job selection, recording facts, critical examination etc. String diagram, Multiple activity chart, Travel chart. Principles of motion economy. Two-handed chart. Fundamental hand motions. Micro-motion and Memo-motion studies. Cyclegraph and Chrono-cyclegraph. Work Measurement (WM). Work sampling. Time study. Computerized WM. PMTS: MTM, Work factor and Standard data. Wage payment and incentive plans. | | |
|  | **Module Aims** | |
|  | **Provide students with:** | |
| An understanding of the definition, necessary backgournd and importance of the subject of Work Analysis and Design, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Be able to analyze and evaluate the productivity of people and machines in manual and semi-automated environment. * Be able to use the tools and techniques of method study (Charts/diagrams) * Be able to use the tools and techniques of work measurement * Be able to design, perform and analyze the studies/experiments related to WS (e. g. process analysis, operation analysis, time study, Pre-determined motion time system, Standard data and work sampling). | | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | | |
| Ability to design and conduct experiments, as well as to collect, analyze and interpret data. | | |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in writing. | | |
| The skills of good technical writing. | | |
| The analytical thinking skills. | | |
| Ability for team work. | | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | | |
| An understanding of professional and ethical responsibility. | | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design and conduct experiments, as well as to analyze and interpret data. |
| Design a system, component, or process to meet desired needs. |
| Identify, formulate, and solve engineering problems. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Introduction to Work Study, International Labor Office:Geneva, 4th Revised edition, 1992
* Work measurement and Methods Improvement, Lawrence, SA, John Wiley & Sons
* Motion and Time Study: Design & Measurement of Work, Barnes, RM, John Wiley & Sons, 2000

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| **Industrial Operations Management** | |
| ME 476 | **Code & No:** |
| 3(3-1-0) | **Credits:** |
| MATH 107 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| --- |
| Basic concepts of Production and Operations Management (POM). Design of products and services. Processes and technologies, Inventory management. Forecasting. Material Requirements Planning (MRP). Scheduling. Supply-Chain management. Just-in-time and lean productionIntroduction to Enterprise Requirement Planning (ERP). Capacity and Aggregate planning. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Industrial Operations Management, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Understand the overall decision making process associated with the field, be able to apply decision making techniques and to understand the strategic implications of decision regarding product, process and site location, * Be able to: forecast demand, apply aggregate planning and master production scheduling techniques, apply basic inventory control, material requirements planning and scheduling models in an operations environment, * To be able to understand the difference between supply chain management and traditional purchasing, | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The analytical thinking skills. | |
| The skills necessary to develop a project or a business plan on a scientific and systematic basis. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design a system, component, or process to meet desired needs. |
| Identify, formulate, and solve engineering problems. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Operations Management, Heizer J. and Render B. Pearson Prentice Hall, 8e, 2007
* Operations Management, Russell R. Taylor III, B.W. Pearson Prentice Hall, 4e, 2003

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| **Human Factors Engineering Lab** | |
| ME 496 | **Code & No:** |
| 1 (0-0-2) | **Credits:** |
| ME 495 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

|  |  |  |
| --- | --- | --- |
| Introduction to human factors engineering. Muscular work. Nervous control. Work efficiency. Body size and anthropometrics. Work station design. Heavy work. Handling loads. Man-machine systems. Mental activity. Fatigue. Stress and boredom. Vision and lighting. Noise and vibration. | | |
|  | **Module Aims** | |
|  | **Provide students with:** | |
| An understanding of the definition, necessary backgournd and importance of the subject of Human Factors Engineering, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Understand how people fit into technological systems * Recognize the limits of human perceptual-motor capabilities. * Recognize the limits of human cognitive functioning and why people make errors. * Recognize the human indicators of fatigue and stress. * Be able to write reports that describe human performance. * Be able to assess workstation and task design for ergonomic deficiencies. And appreciate the importance of organization and job design factors for performance and satisfaction. * Be able to define safety hazards and general approaches for their control. | | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools necessary for engineering practice. | | |
| Ability to design and conduct experiments, as well as to collect, analyze and interpret data. | | |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in writing. | | |
| The skills of good technical writing. | | |
| The analytical thinking skills. | | |
| Ability for team work. | | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | | |
| The skills necessary to demonstrate cooperative planning and problem solving. | | |
| The skills necessary to develop a project or a business plan on a scientific and systematic basis. | | |
| An understanding of professional and ethical responsibility. | | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design and conduct experiments, as well as to analyze and interpret data. |
| Function on multi-disciplinary teams. |
| Identify, formulate, and solve engineering problems. |
| Understand professional and ethical responsibility. |
| Communicate effectively. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Fitting the Task to the Human: A Text Book of Occupational Ergonomics, Kroemer, KHE & Grandjean, E. Taylor & Francis Publishers, London, 5e, 1997
* Occupational Ergonomics, Principles & Applications, Tayyari, F & Smith, J, Chapman & Hall: London, 1997

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| **Engineering Design** | |
| ME 477 | **Code & No:** |
| 3 (3-1-0) | **Credits:** |
| ME 306 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| Engineering design process. Computer modeling and heuristics for solving problems, in teams, in the areas of comparison of strategies, trade-offs, decision making, stochastic processes, optimization and expert systems. Interpretation of results. Preparation of professional technical reports of engineering work and multimedia presentation. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Engineering Design, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Be able to identify the most relevant needs (objectives) from an open ended problem. * Be able to breakdown an open ended problem into its main elements (variables, constraints, parameters, etc.) * Be able to develop alternative models by using basic mathematical, scientific and engineering knowledge. * Be able to choose the best model. * Be able to solve the model by a suitable computer software/tool. * Be able to test the model and analyze the results to determine if they are sufficient. * Be able to evaluate the solution and argue suitable improvements and changes. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools necessary for engineering practice. | |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in writing. | |
| Skills of hand drawing of sketches. | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design a system, component, or process to meet desired needs. |
| Identify, formulate, and solve engineering problems. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* How To Model It, Problem Solving for the Computer Age, Anthony M. Starfield, Karl A. Smith, and Andrew L. Bleloch, McGraw-Hill, 1994

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| **Industrial Management** | |
| ME 478 | **Code & No:** |
| 3 (3-1-0) | **Credits:** |
| ME 306 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| Introduction to industrial management. Economic concepts in industry. Organizational structure and design. Human resource management. Motivating the work force. Managing information technology. Financial management. Engineers in marketing and services. Job analysis, job description, and job specification. Preparation of business plan. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Industrial Management, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * To be able to comprehend management function in industry (Planning, Organizing, staffing, and Control.). * Understand Organizational structure and design. * Understand Human resource management tasks: Job analysis, Job description, Job specification, Preparation of business plan, Motivation of work force, * Understand concepts of: information technology management, and financial management. * Recognize economic concepts in industry. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | |
| The skills necessary to develop a project or a business plan on a scientific and systematic basis. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Identify, formulate, and solve engineering problems. |
| Understand professional and ethical responsibility. |
| Communicate effectively. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Excellence in Business, Edition 3rd, Bovee. Thill. Mescon, Prentice Hall.
* Business A Changing World, 5/e: Ferrel Hirt Ferrel, McGraw-Hill 2006.
* Contemporary Business, Louis E Boone, David L Kurtz, Thomson South-Western.

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| **Manufacturing Economics** | |
| ME 479 | **Code & No:** |
| 3 (3-1-0) | **Credits:** |
| MATH 204 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

|  |  |
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| Basic accounting concepts; Cash flow and financial statements analysis; Standard costs and variance analysis; Cost analysis and operation decisions; introduction to cost reduction programs. | |
|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Manufacturing Economics, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Understand cost terms, the concepts of cost analysis, and management accounting. * Be able to calculate and apply Cost-Volume-Profit Analysis * Be able to make decisions by Measuring relevant cost and revenues. * Be able to calculate and explain the cost assignment. * Be able to compute and explain Activity based costing * Be able to use the techniques, skills, and modern engineering tools necessary for cost decision practices | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Identify, formulate, and solve engineering problems. |
| Understand professional and ethical responsibility. |
| Communicate effectively. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Financial and Cost Analysis for Engineering and Technological, Management, H. Riggs, Wiley & Sons.

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| **Industrial Information Systems** | |
| ME 480 | **Code & No:** |
| 3 (3-1-0) | **Credits:** |
| NA | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| General concepts. Values and attributes of information. Different types of information systems. Concepts of managerial information systems. Emphasis on analysis, design, and development of industrial information systems. Developing information systems by using microcomputers. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Industrial Information Systems, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Understand the different types of information systems. * Be able to: design, develop, and analyze industrial information systems. * Be able to develope information systems by using microcomputers. * Identify ethical implications of Information Systems. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The analytical thinking skills. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Understand professional and ethical responsibility. |
| Communicate effectively. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Information Systems in Business: An Introduction, James O. Hick,West Publishing Co.

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| **Safety Engineering** | |
| ME 481 | **Code & No:** |
| 3 (3-1-0) | **Credits:** |
| GE 101 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| --- |
| Accident: causes and costs. Appraising safety performance and risk assessment. Analysis of accident causes. Accident reports and records. Job safety analysis. Plant inspection. Accident investigation. Plant layout and arrangement. Plant housekeeping. Maintenance and safety. Material handling and safety. Machine guarding. Explosion and fire prevention. Personal protection. First aid. Planning for emergencies. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Safety Engineering, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Understand different forms of occupational hazards. * Be able to apply analytical tools to define occupational hazards. * Be able to apply intervention strategies for ameliorating occupational hazards. * know where to find information resources regarding occupational hazards. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools necessary for engineering practice. | |
| The skills necessary to develop a project or a business plan on a scientific and systematic basis. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Identify, formulate, and solve engineering problems. |
| Understand professional and ethical responsibility. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Industrial Safety and Health Management, C. Ray Asfahl, Prentice Hall, 1998.
* Safety, Health, and Environmental Protection, Charles, A. Wwntz, McGraw-Hill, 1998.

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| **Industrial Systems Simulation** | |
| ME 482 | **Code & No:** |
| 3 (2-1-2) | **Credits:** |
| ME 474 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| --- | --- | --- | --- |
| Basic theory of industrial simulation. Building simulation models. Organization of simulation studies. Simulation modeling and application to medium and large-scale production and service system problems. Output analysis. Variance reduction and optimization. Use of software such as ARENA for discrete and continuous system simulation. | | | |
|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Industrial Systems Simulation, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Understand the major capabilities and limitations of discrete-event simulation for modeling types of systems that industrial engineers commonly encounter. * Be able to build and run simple discrete-event simulation models in practical situations. * Understand the main assumptions underlying these models, and what can happen when these assumptions do not hold. * Be able to use simulation software tools to model a system and to estimate performance measures of the system. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | |
| Skills required for the use of mathematical modeling in solving various engineering problems. | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in writing. | |
| The analytical thinking skills. | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design a system, component, or process to meet desired needs. |
| Identify, formulate, and solve engineering problems. |
| Understand professional and ethical responsibility. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Simulation with Arena, W. David Kelton, Randall P. Sadowski, and David T. Sturrock, 3rd Ed. 2004, McGraw-Hill.
* Simulation Modeling and Analysis 3rd Edition, A. L. Law, David Kelton, 3rd Ed, 2000, McGraw-Hill.

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| **Design & Analysis of Experiments** | |
| ME 483 | **Code & No:** |
| 3 (3-1-0) | **Credits:** |
| STAT 101 -ME 111 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Principles of experimental design. Randomized complete block designs. Latin square and Graeco-Latin square designs. General factorial designs. 2k Factorial designs. Response surface methodology and robust design. Planning, performing and analyzing industrial experiments. |

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|  | Module Aims |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Design & Analysis of Experiments, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * know how to design an experiment using the appropriate method and data analysis needed, | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Skills required for the use of mathematical modeling in solving various engineering problems. | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| Ability to design and conduct experiments, as well as to collect, analyze and interpret data. | |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in writing. | |
| The analytical thinking skills. | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design and conduct experiments, as well as to analyze and interpret data. |
| Identify, formulate, and solve engineering problems. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Design & Analysis of Experiments, Montgomery Douglas C, John Wiley and Sons, New York, 6e, 2005

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| **Industrial Facilities Planning** | |
| ME 484 | **Code & No:** |
| 3 (3-1-0) | **Credits:** |
| ME 495 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Fundamentals of facilities planning. Facilities design. Flow, space, and activity relationships. Material handling systems. Layout planning models. Warehouse operations. Quantitative facilities planning models. Preparing, presenting, implementing and maintaining facilities plan. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Industrial Facilities Planning, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * To develop skills and learn modern analytical techniques useful for solving facilities planning problems in such areas as: Manufacturing Systems Design; Plant Layout; Material Handling Systems, Warehouse operations; Conveyors; and Cellular Manufacturing Systems * Understand the many qualitative considerations relevant to solving facilities planning problems. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| Skills of hand drawing of sketches. | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| The skills necessary to develop a project or a business plan on a scientific and systematic basis. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Function on multi-disciplinary teams. |
| Identify, formulate, and solve engineering problems. |
| Understand professional and ethical responsibility. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Facilities Planning, Tompkins, White et al. John Wiley, New Jersey, 2003.
* Manufacturing Facilities Design and Material Handling, Fred E. Meyers and Mathew Stephens, Pearson Prentice Hall, New Jersey, 2005.

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| **Occupational biomechanics (Ergonomics)** | |
| ME 485 | **Code & No:** |
| 3 (2-1-2) | **Credits:** |
| ME 495 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Introduction to Occupational Biomechanics. Review of kinematics and kinetics. Anthropometry. Mechanical work-capacity evaluation. Bio-instrumentation for Occupational Biomechanics. Biomechanical models. Methods of classifying and evaluating manual work. Manual material handling limits. Biomechanical considerations in machine control and workplace design. Hand tool design guidelines. Guidelines for seated work. |

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|  | **Module Aims** | |
|  | **Provide students with:** | |
| An understanding of the definition, necessary backgournd and importance of the subject of Occupational biomechanics, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Learn the basic concepts and design tools needed to consider the physiological basis of human work in the design of industrial operations, equipment and products. * Understand how to design workspaces to accommodate human dimensions * Learn how to determine when loads and forces encountered in manual tasks exceed human strength limits * Understand how to prevent fatigue * Learn how to design work environments * Learn how to design physically demanding work for hot and cold environments * Learn how to establish work schedules that prevent adverse effects of shift work * Learn how to design manual material handling tasks that prevent back injuries | | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools necessary for engineering practice. | | |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in writing. | | |
| The skills of good technical writing. | | |
| The analytical thinking skills. | | |
| Ability for team work. | | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | | |
| An understanding of professional and ethical responsibility. | | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | | |
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**Outcomes**

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| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design a system, component, or process to meet desired needs. |
| Identify, formulate, and solve engineering problems. |
| Understand professional and ethical responsibility. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Fitting the Task to the Human: A Text Book of Occupational Ergonomics, Kroemer, KHE & Grandjean, E. Taylor & Francis Publishers, London, 5e, 1997
* Occupational Ergonomics, Principles & Applications, Tayyari, F & Smith, J, Chapman & Hall: London, 1997

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| **Design of Manufacturing Systems** | |
| ME 486 | **Code & No:** |
| 3 (2-1-2) | **Credits:** |
| ME 475 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Study of recent developments in manufacturing, Japanese manufacturing techniques, hybrid manufacturing management system, supply chain management, total quality management, design for manufacturing and assembly.  Manufacturing automation fundamentals and strategies; High volume manufacturing systems; Automated handling and storage systems; Automated inspection systems; Flexible manufacturing systems; Modeling of manufacturing systems. | |
|  | | **Module Aims** |
|  | | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Design of Manufacturing Systems, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Gain detaild knowledge in three areas: manufacturing processes and computer-integrated manufacturing systems, manufacturing system design and analysis, and modern manufacturing management strategies. | | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design a system, component, or process to meet desired needs. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Production System and Computer Integrated Manufacturing, Groover, M.P. Automation, Prentice Hall.
* Modeling and Analysis of Manufacturing Systems, Askin, R.G. & Standridge, C.R. John Wiley & Sons.
* Factory Physics, Hopp and Spearman, Irwin 1996.

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| **Product Design and Innovation** | |
| ME 427 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 323 – ME 212 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Introduction to manage innovation; Idea generation: use of scientific and technical  knowledge to build product ideas; Product specification and quality Standardization of product; Product structure and components. Implementing prototype metrologies. Reverse engineering process and procedures & prototyping |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Product Design and Innovation, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Understand how to generate and evaluate creative ideas for the product, * Understand how to identify a potentially successful new product, * Understand how to manage the data and knowledge creayed during product development, * Understand and practice reverse engineering process. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Skills required for the use of modeling and prototyping to solve different engineering problems. | |
| Skills required for the use of mathematical modeling in solving various engineering problems. | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools necessary for engineering practice. | |
| Ability to design and conduct experiments, as well as to collect, analyze and interpret data. | |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in writing. | |
| Skills of hand drawing of sketches. | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| Ability for team work | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design and conduct experiments, as well as to analyze and interpret data. |
| Design a system, component, or process to meet desired needs. |
| Function on multi-disciplinary teams. |
| Identify, formulate, and solve engineering problems. |
| Communicate effectively. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Product Design and Development, Ulrich and Eppinger, McGraw-Hill, 2e, 2000

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| **Computer Integrated Manufacturing** | |
| ME 418 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 212 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Introduction; Computer Aided Process Planning; Automated handling system and AS/RS concept, and configuration; Industrial Robots; Cellular Manufacturing Systems (CMS); Flexible Manufacturing Systems (FMS); Enterprise Integration and ERP. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Computer Integrated Manufacturing, in addition to the abilty to apply the breadth and depth of this subject including the basic terminology, concepts, principles and theories of it in order to:   * Gain an understanding of: Computer Aided Process Planning; Automated handling system, Industrial Robots; different Manufacturing Systems, * Be able to use Computer Integrated Manufacturing software tools, * Be able to design and develop control programs for various manufacturing equipment and judge their effectiveness. | |
| Ability to follow a scientific methodology in using the basics and principles of mechanical engineering in handling engineering applications | |
| Experience and skills necessary to take advantage of computer in dealing with different engineering applications. | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools necessary for engineering practice. | |
| Ability to design and conduct experiments, as well as to collect, analyze and interpret data. | |
| The analytical thinking skills. | |
| Ability for team work | |
| The skills necessary to define, analyze, and solve problems to reach proper conclusions and to communicate these conclusions with others. | |
| The skills necessary to demonstrate cooperative planning and problem solving. | |
| An understanding of professional and ethical responsibility. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design a system, component, or process to meet desired needs. |
| Understand the impact of engineering solutions in a global and societal context. |
| Recognize the need to engage in life-long learning. |
| Gain knowledge of contemporary issues. |
| Use the techniques, skills, and modern engineering tools necessary for engineering practice. |

**Textbooks and References**

* Chang, T.C. Wysk, R.A. & Wang, H.P, "Computer Aided Manufacturing," Prentice Hall, 1991.
* Bedworth, D.P. Henderson, M.R. & Wolfe, P.M. "Computer Integrated Design and Manufacturing," McGraw-Hill College, 1991.