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| **Material Removal Processes** | |
| ME 313 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 212 – ME 232 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 8 | **Level:** |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Material Removal Processes, 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: Mechanics of chip formation, Cutting forces and power, Effect of temperature on cutting and tool life, Metal removal rate, Cutting tool materials and cooling fluids used. * Be familiar with different Machining processes, * Be familiar with latest techniques in cutting process, e.g. Non-conventional machining and Numerical control of machine tools. | |
| 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. | |
| Ability for team work | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |

**Module Description**

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| Fundamentals of cutting. Mechanics of chip formation. Cutting forces and power. Effect of temperature on cutting. Tool life. Machinability: Metal removal rate, Cutting tool materials and fluids. Machining processes: turning, thread cutting, boring, drilling, reaming, milling, shaping and planing, broaching, gear cutting. Abrasives, grinding wheels, grinding processes. Super finishing process: Lapping, honing. blasting and peening. Non-conventional machining. Numerical control of machine tools. |

* Metal cutting theory and practice, David A. Stephenson and John S. Agapiou, Marcel Dekker INC, 1996
* Metal Cutting Mechanics, Viktor P. Astakhov, CRC Press LLC, 1999

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| **Materials Selection in Design** **and Manufacturing** | |
| ME 333 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 212 + ME 232 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 8 | **Level:** |

**Module Description**

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| Product life cycle. Performance of materials in service (failure of materials under mechanical loading, environmental degradation, selection of materials), effect of shape and manufacturing processes. Cost-per-unit-property method. Weighed properties method. Limits-on-properties method. Selection charts, computer-aided material and process selection (material databases). Case studies. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Materials Selection in Design and 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:   * Product life cycle, Performance of materials in service, Effect of shape and manufacturing processes on performance of materials in service, * Understand different selection methods (Cost-per-unit-property, Weighed properties, and Limits-on-properties), * Be able to use selection charts, materials data base | |
| 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 of good technical writing. | |
| 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. |
| 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. |

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|  | **Textbooks and References** |

* [Joseph Datsko](http://www.amazon.com/Joseph-Datsko/e/B001KHYDSW/ref=ntt_athr_dp_pel_1), "Materials Selection for Design and Manufacturing," 2ed, CRC Press, 1997.
* Michael F. Ashby, "Materials Selection in Mechanical Design," 2ed, Butterworth-Heinemann, 1999.

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| **Fault Diagnosis of Mechanical Systems** | |
| ME 345 | **Code & No:** |
| 2 (1-1-2) | **Credits:** |
| ME 343 + ME 232 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 8 | **Level:** |

**Module Description**

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| Review of vibration: Free Vibration, Harmonically Excited Vibration, Fourier Analysis. Instruments: Transducers, FFT Analyzer, Sampling and Aliasing. Vibration problems: Imbalance, Misalignment, Bearings, Gears, Fans, Belts. Techniques and Maintenance Management. Sound; Basic Properties of Waves, Intensity, Power Level. Balancing: Static Unbalance, Dynamic Unbalance, Field Balancing. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Fault Diagnosis of Mechanical 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; Vibration problems, Imbalance, Misalignment, and problems of; Bearings, Gears, Fans, Belts. * Understand machine fault detection methods including and the use of signal models, * Understand balancing: Static Unbalance, Dynamic Unbalance, Field Balancing. | |
| 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. | |
| The experience and skills necessary to use resource materials, technical equipment and engineering tools necessary for engineering practice. | |
| 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. | |
| An understanding of professional and ethical responsibility. | |
| 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. |
| 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. |

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|  | **Textbooks and References** |

* Machinery Vibration: Measurement and Analysis, Victor Wowk, McGraw-Hill, Inc. 1991
* Lecture Notes

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| **Computer Aided Design** | |
| ME 424 | **Code & No:** |
| 3 (2-0-3) | **Credits:** |
| ME 323 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

|  |
| --- |
| Introduction to computer aided engineering environment. Solid modeling. Introduction to Finite Element Method. CAD packages. Static linear analysis in one, two, and three dimensions. Thermal analysis, introduction to non linear analysis. Optimum design. Computer applications in mechanical design. |

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| **Module Aims** |
| **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Computer Aided 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 use CAD packages and generate solid modeling of mechanical parts, * Be able to apply Linear and Nonlinear analysis and Finite Element Method in design of mechanisms, * Gain an understanding of Optimum design, |
| 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 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. |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering area. |

**Outcomes**

|  |
| --- |
| Apply knowledge of mathematics, science, and engineering. |
| Design a system, component, or process to meet desired needs. |
| Function on multi-disciplinary teams. |
| 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. |

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|  | **Textbooks and References** |

* The Finite Element Method in Machine Design, Eliahu Zahavi, Prentice Hall, 1992
* Mechanical Engineering Design, Shigley J. E. and Mischke C. R. McGraw-Hill, 2001

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| **Metal Forming Processes** | |
| ME 414 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 212 + ME 232 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

|  |
| --- |
| Yield criteria, plastic stress-strain relations. Plane stress, plane strain. Determination of flow stress. Applications in beam bending, instability in thin shells. Classification of metal forming processes. Bulk deformation processes. Techniques of analysis: slab method, upper bound method. Slip-line fields, application to indentation problem. Forging, rolling, extrusion. Rod and wire drawing equipment and dies. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Metal Forming Processes, 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 understanging of metal forming processes and the advantages and disadvantages of each, * Be able to select the forming method and the process parameters based on the features and application of the component, * Be able to analyze reasons for defects and suggest suitable remedies for reduce it, | |
| 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 | |
| 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. |
| Understand professional and ethical responsibility. |
| Communicate effectively. |
| 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. |

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|  | **Textbooks and References** |

* Manufacture Process for Engineering Materials, Addison, Wesley, 2005
* Mechanical Metallurgy, Mc-Graw Hill, 1976
* Engineering Plasticity, Van-Nostrand Reinhold, 1973.

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| **Design and Production Lab (1)** | |
| ME 491 | **Code & No:** |
| 1 (0-0-2) | **Credits:** |
| ME 111 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| The design, execution, and evaluation of physical experiments in the area of solid mechanics, dynamics of physical systems and control. Digital simulation of linear systems using a software package (MATLAB). Emphasis on the application of classroom theory to experimental engineering and interpretation and presentation of results. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| * Gain an understanding regarding carrying out lab experements in areas of mechanical design, material enginnering, system dynamics, automatic control and mechanical vibrations. * Show ability for data collection and analysis, Analog and digital signal analysis, Instrumentation specifications, etc. * Have hands on laboratory experience of the experimental and practical design aspects of important mechanical engineering concepts * Be able to apply digital simulation of linear systems using a software package (MATLAB) * Be able to write good technical reports | |

**Outcomes**

|  |
| --- |
| 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. |
| 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. |
| 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. |

**Textbooks and References**

* NA

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| **Computer Aided Manufacturing** | |
| ME 415 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 212 – ME 424 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| --- |
| Automation strategies. Production economics. High volume production systems. Automated flow lines. Assembly and line balancing. Numerical control. NC part programming. DNC, CNC, and adaptive control. Industrial robots. Material handling and storage. Group technology and flexible manufacturing. Quality control and automated inspection. Control systems. Programmable controllers. Computer networks. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Computer Aided 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 understandings of; Automation strategies, Automated flow lines. Assembly line balancing. Numerical control. NC part programming. DNC, CNC, and adaptive control, Industrial robots, Material handling and storage. Group technology and flexible manufacturing, Automated inspection. * Be able to perform basic CNC programming to direct a CNC machine to mchine parts, * Be able to optimize closed-loop feedback geins to quicken the response and increase the accuracy of position servomechanism | |
| 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. | |
| 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. | |
| 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. |
| Design a system, component, or process to meet desired needs. |
| 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**

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

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| **Design and Production Lab (2)** | |
| ME 492 | **Code & No:** |
| 1 (0-0-2) | **Credits:** |
| ME 491 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Continue the course of Mechanical Design and Production Lab I concerning the design, execution, and evaluation of physical experiments in the area of solid mechanics, dynamics of physical systems and control. Digital simulation of linear systems using a software package (MATLAB). Emphasis on the application of classroom theory to experimental engineering and interpretation and presentation of results. |

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|  | **Module Aims** |
|  | **Provide students with:** |
| * The skills necessary to carry out lab experements in areas of mechanical design, material enginnering, system dynamics, automatic control and mechanical vibrations, showing enough ability for data collection and analysis, Analog and digital signal analysis, Instrumentation specifications, etc. * Have hands on laboratory experience of the experimental and practical design aspects of important mechanical engineering concepts. * Be able to apply digital simulation of linear systems using a software package (MATLAB) | |
| 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. | |
| 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. |

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|  | **Textbooks and References** |

* NA

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| **Powder Metallurgy** | |
| ME 434 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 232 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| --- | --- | --- |
| Introduction, powder metallurgy process, production of ferrous powder, powder, shaping, compaction, sintering behavior, microstructure changes, full-density, processing, heat treatment, finishing operations and properties, design consideration, products and applications. | | |
| **Module Aims** | | |
| **Provide students with:** | | |
| An understanding of the definition, necessary backgournd and importance of the subject of Powder Metallurgy, 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 the powder metallurgy process and its parameters, heat treatment, finishing operations and properties, * Be familier with design considerations, and the unique properties of the products and applications of Powder Metallurgy. | | |
| 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. | | |
| 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 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**

* Powder metallurgy of Iron and Steel, Randal M. German, John Wiley & Sons, 1998

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| **Composite Materials** | |
| ME 435 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 232 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| Classification. Applications. Processing and fabrication of composites (metal-matrix, ceramic-matrix, reinforced plastics, honeycomb materials, forming structural shapes). Design Considerations. Laminate structures. Stress-strain characteristics of fiber-reinforced materials. Lamination theory. Failure theories of fiber-reinforced materials. Environmentally induced stresses in laminates. |

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| **Module Aims** | |
| **Provide students with:** | |
| An understanding of the definition, necessary backgournd and importance of the subject of Composite Materials, 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 familiar with: Material classification, Applications Design Considerations, Processing and fabrication of composites, * Be able to analyze composite materials, * Gain a prespective on the utilization of advanced composite materials in machine parts and structure. | |
| 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. | |
| The analytical thinking skills. | |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. | |
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**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. |

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|  | **Textbooks and References** |

* Advanced Composite Materials, Louis A. Pilato and Michael J. Michno, Springer, 1994
* Mechanics of Composite Materials, Robert John, Taylor & Francis Inc, 1999

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| **Introduction to Nanomaterials** | |
| ME 436 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 232 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| --- |
| Introduction and Definition, Types of nano materials, Nano composites, Mechanical Behavior of materials from Micro to nano level, Nano materials and nano structures, Mechanical, physical, electrical, optical and magnetic properties of nano materials, Failure mechanism in nano materials, Fatigue and Fracture of MEMS and NEMS, Characterization Techniques HRTEM, AFM, Raman Spectroscopy, Potential applications of nano materials. |

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| **Module Aims** |
| **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Introduction to Nanomaterials, 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: Nanomaterials types, Nano composites, Nano materials and nano structures, Mechanical, physical, electrical, optical and magnetic properties of nano materials, Failure mechanism in nano materials, and Potential applications of nano materials, |
| 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. |
| 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 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

* Nanomaterials, Nanotechnologies and Design, An Introduction for Engineers and Architects, Daniel L. Schodek, Paulo Ferreira and Michael F. Ashby, Elsevier Inc, 2009

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| **Non destructive Examination of Materials** | |
| ME 437 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 232 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 9 | **Level:** |

**Module Description**

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| Introduction to the fundamentals and applications of non destructive examination. Nondestructive Examination Methods: Ultrasonics, Magnetic Particle, Liquid Penetrant, Acoustic Emission, Eddy Current, Radiography; Qualification and Certification of NDT Personnel. |

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| **Module Aims** |
| **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Non destructive Examination of Materials, 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 familiar with Nondestructive Examination Methods and Applications, * Be aware of limitations of NDT, * Be able to evaluate data from NDT, * Be aware of Qualification and Certification of NDT Personnel. |
| 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. |
| 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. |
| 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. |
| 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. |

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|  | **Textbooks and Reference** |

* Nondestructive Testing Techniques, Ravi, Dean, Research & Consultancy Division, and Birla Institute of Technology & Science, New Age Science, 1999
* Practical Non-Destructive Testing, B. Raj, Alpha Science Int'l Ltd; 3rd edition, 2007

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| **Machine Tools Design** | |
| ME 425 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 323 – ME 212 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Design and working principles of machine tool elements (Speed and feed of gear boxes. spindle and spindle bearings, rigidity and strengthening of structures- frames, beds and design of slideways against wear). Power sources and types of drives. Mechanisms design, motion control and transmission systems in machine tools. Safety devices. Static and dynamic acceptance tests for machine tools. |

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| **Module Aims** |
| **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Machine Tools 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:   * Understand design and working principles of machine tool elements and Mechanisms, and Safety devices. * Be able to design machine elements to meet design specifications such as material selection, type of geometry, sizing and safety factor; * Be familiar with the right Codes and Standards. |
| 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. |
| Skills of hand drawing of sketches. |
| The skills of good technical writing. |
| The analytical thinking skills. |
| Ability for team work |
| 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. |

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| --- | --- |
|  | **Textbooks and References** |

* Modular design for machine tools, Yoshimi Ito, McGraw-Hill, 2008

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| **Design of Production Facilities** | |
| ME 426 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 323 – ME 212 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Hoisting machinery: crane chains, sprockets, pulleys, drums, ropes, sheaves and hooks. Gain in force and gain in speed systems. Wheels, rails, and drives. Jigs and fixtures: specifications of jigs and fixtures, conventions in fixture design. Degrees of freedom, location points, fixation point. Clamping devices, fool-proofing, Rigidity and wear considerations. | | | |
|  | **Module Aims** |
|  | **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Design of Production Facilities (material handling systems and conveyors), 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 design and working principles of material handling elements and mechanisms, and their safety considerations. * Be able to design material handling elements to meet design specifications such as material selection, type of geometry, sizing and safety factor; * Be familiar with the right Codes and Standards. | |
| 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. | |
| Skills of hand drawing of sketches. | |
| The skills of good technical writing. | |
| The analytical thinking skills. | |
| Ability for team work | |
| 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. |

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|  | **Textbooks and References** |

* Strategies for Creative Problem Solving, Fogler, and LaBlanc, Printice Hall, 1995
* Mechanical Engineering Design, Shigley J.E. and Mischke C.R. McGraw-Hill, 2001

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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. | |
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**Outcomes**

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| --- |
| 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. |

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|  | **Textbooks and References** |

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

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| **Tribology** | |
| ME 428 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 323 – ME 212 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Nature of solid surfaces. Interaction of solid surfaces. Friction of metals and non-metals (mechanisms, theories, applications). Wear of metals and non-metals (types, mechanisms, theories, applications). Lubrication (methods, types, theories, applications). Lubricants (types, utilization) Selection of materials for tribological applications. Surface Engineering. |

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| **Module Aims** |
| **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Tribology, 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 the theory and practice of: Friction, Wear, and Lubrication * To be able to select materials for tribological applications. * Learn about emerging area such as micro-nano tribology. |
| 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. |
| The skills necessary to communicate concepts and experimental results in clear and logical fashion, both verbally and in 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. |
| 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**

* Fundamental of tribology, R. Gohar, Imperial College Press, 2008.
* Engineering Tribology, J. Williams, Cambridge University Press,2005.

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| **Welding Technology** | |
| ME 416 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 212 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Fusion welding. Weldability. Selection of welding electrodes. Hot cracking. Cold cracking. Welding metallurgy, heat affected zone. Welding of heat-treatable alloys. Welding of dissimilar alloys. Destructive and non­destructive testing of welds. Weld thermal cycles and residual stresses. Welding in manufacturing: pressure vessels, boilers and ship building industries; welding in automotive maintenance. Welding codes. |
| **Module Aims** |
| **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Welding Technology, 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 different types of welding techniques, their features, and applications, * Be able to know how to weld various types of materials, * Be able to diagnose welding defect and problem, * Be able to perform different testing for welding zone, * Be aware with welding codes. |
| 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 demonstrate cooperative planning and problem solving. |
| Some of the knowledge and skills necessary to pursue professional careers in mechanical engineering arena. |

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| 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. |

**Outcomes**

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|  | **Textbooks and References** |

* Howard B.Cary, and Scott C. Helzer, "Modern Welding Technology," 6th ed, Prentic Hall, 2004.
* Robert W. Messler, "Principles of Welding: Processes, Physics, Chemistry, and, Metallurgy," 1st ed, Wiley VCH, 1999.

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| **Advanced Manufacturing Technology** | |
| ME 417 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 212 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Non-conventional machining: Principles, Ultrasonic machining, Electromechanical Machining, Electro-discharge Machining, Plasma Arc Machining, Laser Beam Machining, Electron Beam Machining. Numerical Control of Machine Tools: Automation of Manufacturing Processes, Numerical Control, Coordinate systems, Types and components of CNC systems, Programming for CNC, Adaptive control, Computer Integrated Manufacturing. |

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| **Module Aims** |
| **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Advanced Manufacturing Technology, 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 the features of the different types of the nontraditional manufacturing processes, * Be able to present enough knowledge and information following the current trends in manufacturing, * Be abale to evaluate and analyze manufacturing engineering, |
| 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 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. |
| 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. |

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|  | **Textbooks and References** |

* Exploring Advanced Manufacturing Technologies [Illustrated], Steve Krar, Arthur Gill, Industrial Press, Inc. 2003

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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. | |
| **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. | |
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**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. |

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|  | **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.

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| **Finite Elements Methods** | |
| ME 419 | **Code & No:** |
| 3(2-1-2) | **Credits:** |
| ME 232 – ME 424 | **Pre-requisite:** |
| NA | **Co-requisite:** |
| 10 | **Level:** |

**Module Description**

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| Virtual formulation. Finite element analysis: shape formation, equilibrium conditions, element classification, assembly of elements, modeling methodology. Structures and elements: trusses, beams, 2-D solids, 3-D solids, axisymmetric solids, thin-walled structures. Dynamic analysis. Heat transfer and thermal analysis. |

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| **Module Aims** |
| **Provide students with:** |
| An understanding of the definition, necessary backgournd and importance of the subject of Finite Elements Methods, 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 finite element formulation for different engineering applications, * Be able to use finite elemet software tools |
| 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 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 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**

* Finite Element Procedures, Bathe, K. J. Prentice-Hall, 1995.