DESCRIPTION OF GRADUATE COURSES

ME 50l Experimental Dynamics Analysis (3-0)3
Analysis of data defining vibration conditions and the transformation of a time-history of a vibration measurement into more compact forms of data. General principles of shock and vibration measuring instruments and mathematical basis for the measurement of shock and vibration. Equipments, instruments, and procedures employed in vibration tests. Vibration testing machines. Dimensional analysis and models for vibration and shock studies. Analogue methods in vibration analysis. The theory of vibration isolation including the application and design of isolators.

ME 502 Advanced Dynamics (3-0)3
Hamilton's principle. Generalized variables. Lagrange's equation. Rigid body dynamics arid systems with gyroscopic effects. Gyroscopic effects on spinning; shafts and critical speeds. Gyrocompass, international navigation. Vibration of systems with time varying and nonlinear characteristics. Hamilton's principle applied to distributed systems and to systems with electromechanical transducer components

ME 503 Advanced Heat Conduction I (3-0)3,
General and particular laws of conductive heat transfer. Formulation of the conduction equation. Boundary and initial conditions. Exact solutions. Approximate solutions by perturbation methods and numerical methods.

ME 504 Advanced Heat Convection I (3-0)3
General and particular laws of convective heat transfer. Formulation of the conservation equations. Differential and integral equations of the boundary layer. Exact solutions for selected problems. Laminar and turbulent internal heat transfer Laminar and turbulent external heat transfer.

ME 505 Advanced Thermal Radiation I (3-0)3
Electromagnetic background. Definition of fundamentals concepts. Interaction of radiation with homogeneous matter. Interaction of radiation with interfaces. Black body radiation. Radiation from real surfaces. Radiation energy transfer in enclosures. Radiation in absorbing-emitting homogeneous media.

ME 506 Two-Phase Flows and Heat Transfer (3-0)3
Space and time averaged formulation of two-phase flows. The Drift Flux Model. Constitutive laws. Two-phase flow patterns and their relationship to heat transfer. Scaling and modeling of two-phase flows. Fundamentals of two-phase flowinstabilities. Analysis of annular flow. Flooding and flow reversal in annular flows. Burnout and rewetting

ME 507 Heat Transfer with Phase Change(3-0)3
Local instantaneous formulation of the interfacial conditions between phases undergoing phase change. Condensation on the surfaces of various geometries. Analysis of various freezing and melting problems. Boiling heat transfer. Nucleation phenomena. Augmentation in boiling and condensation heat transfer. Stability analysis of phase change interfaces.

ME 508 Computational Fluid Dynamics (3-0)3
The mathematical models for fluid flow simulations at various levels of approximation. Basic equations of fluid dynamics. Mathematical nature of the flow equations and their boundary conditions. Basic discretization techniques. The finite difference method, the finite element method and the finite volume method. The analysis of numerical schemes. The resolution of discretized equations. Applications of CFD to incompressible fluid flow problems.

ME 509 Thermal Regenerators (3-0)3
Formulation of partial differential equations for regenerators with heat and mass transfer. Analyses of second order hyperbolic partial differential equations via application of Riemann-Green Function Method and numerical methods. Thermal Shock waves in regenerators. Energy conservation in HVAC and other industrial systems through utilization of regenerators.

ME 510 Simulation of Mechanical Systems (3-0)3
Introduction to principles of design, mathematical fundamentals of modeling. Models, use, formulation and as tools of design, simulation, analogue models, analogue computers, mathematical models, hybrid and digital system simulation

ME 511 Advanced Robotics (3-0)3
An overview of mechanics, dynamics and control of manipulators. Forward and Inverse Kinematics for manipulators having 6 DOF's. Manipulator dynamics. Dynamic model generation and verification. Model-based position control Cartesian Space and Joint space position control. Force control; force-based and position-based force control. Importance of Dynamic Models for robot force control.

ME 512 Advanced Vibration (3-0)3
Advanced principle of dynamics. Work and energy of single particle Strain energy. Elasticity. Variational principles. Hamilton's principle. Vibration of continuous systems. Vibration of strings, longitudinal vibration of bars. Torsional vibrations of bars. Free transverse vibrations of uniform bars under various loads and conditions. Forced vibrations of bars. Response of a uniform beam to a concentrated travelling load. Transverse vibration of a bar on an elastic foundation.

DESCRIPTION OF GRADUATE COURSES

ME 513 Kinematic Anal. of Mechanisms (3-0)3
Analytical representation of motions, transfer matrices, Euler-Savary equation, concept of centrode curvature theory. Three, four and five positions of a plane. Instantaneous invariants and higher accelerations. Cams. Intermittent motion mechanisms. Computer application in kinematic analysis.

ME 514 Robot Vision and Photogrammetry (3-0)3
Basic definitions, digital image representation, cameras and interfaces, Lightness and color image description by edge finding and region growth. Camera calibration and metering in camera coordinates. Stereovision and photogrammetry. Description of motion via photogrammetry and applications in robotics

ME 515 Advanced Gas Dynamics (3-0)3
Review of one-dimensional gas dynamics. Wave propagation. Multi-dimensional equations of gas dynamics. Flow with small perturbations. Methods of characteristics. Solution of supersonic two-dimensional flows with applications

ME 516 Fluid Power Control (3-0)3
Theory and design of hydraulic and pneumatic control systems and components, and their applications. Pressure-flow relationship for hydraulic and pneumatic valves. Valve configurations. Valve operating forces. Closed loop systems. Problems in the control and measurement of pressure, flow, speed, position. Force and other quantities. Application of basic principles to component and system design. Design and application of pure fluid amplifiers, logic elements and systems

ME 517 Advanced Fluid Mechanics (3-0)3
Fundamental concepts. Mathematical preliminaries. Fundamental equations of flow. Analysis of motion. Analysis of force and stresses. Equations of flow. Incompressible 2-D potential flow

ME 518 Boundary Layer Theory I (3-0)3
Outline of boundary layer theory. Derivation of boundary layer equations for 2-D flow. General properties of the boundary layer equations. Exact solutions of the steady state 2-D boundary layer equations. Approximate methods for the solution of 2-D, steady boundary layer equations. Axially symmetrical and 3-D boundary layers. Boundary layer control in laminar flow.

ME 519 Experimental Methods in Fluid Dynamics (3-0)3
Measurement techniques of flow parameters and fluid properties. Hot wire anemometry, instrumentation, data collection and error analysis

ME 520 Environmental Heat Transfer (3-0)3
Transient heat transfer and moisture diffusion in building elements. Analysis of condensation inside walls. Complex thermal system analysis via steady state and transient nodal methods. Radiative and convective coupling in cavity walls, double-glazing, insulating and shading elements. Thermal and phase change coupling inside walls. Analysis of transient heat storage. Transient behaviour of floor heating. Transient thermal storage into soil, rock beds, and water tanks with thermal stratification. Transient storage with phase change.

ME 521 Computational Heat Transfer (3-0)3
Partial differential equations for momentum, kinetic energy, dissipation and temperature in convective heat transfer. Finite difference representations using primitive field variables. Analysis of elliptical and parabolic problems using SIMPLE and SIMPLER methods. Analysis of irregular domain problems using elliptic grid generation techniques.

ME 522 Turbulence Modeling for CFD (3-0)3
Turbulence modeling, its limitations, and current status. A concise description of turbulence and the process of arriving at the Reynold-averaged Navier-Stokes equations. Zero-, one-, and two equation eddy viscosity models. Incorporating advanced models into numerical schemes. Applications of models to boundary layer equation formulations. A brief discussion of direct numerical simulation of turbulence ends the theory of chaos

ME 523 Advanced Control System Analysis and Design (3-0)3
Introduction, transfer matrix, controllability, observability, Liapunov stability analysis. Linear time varying systems. Control system designing via pole placement. Design of servo systems. Quadratic optimal systems. Adaptive control systems. Model reference control systems.

ME 524 Industrial Air Conditioning and Refrigeration Design (3-0)3
Industrial air conditioning load calculations. Air conveying and distribution; fan, duct design and diffusion apparatus. All year air conditioning methods, equipment and their automatic control in various applications. Refrigeration load calculations, writing specifications. Selection and design of equipment.

DESCRIPTION OF GRADUATE COURSES

ME 525 Boundary Layer Theory II (3-0)3
Flow instability. Origin of turbulence transition. Fundamentals of turbulent flow. Theoretical assumptions for the calculation of turbulent flows. Turbulent flow through pipes. Turbulent boundary layers at zero pressure gradient, flat plate, rotating disk and roughness. The incompressible turbulent boundary layer with pressure gradient.

ME 526 Biomech. of Human Movement (3-0)3
Introduction to biomechanical analysis of human movement, description of the mechanical properties of bone, tendon, ligaments, cartilage, muscles and soft tissues. The relation between structure and function of biomaterials. Introduction to descriptive analysis of human movement.

ME 527 Advanced Int. Comb. Engines (3-0)3
Thermo chemistry of fuel air mixtures, properties of working fluids, ideal models of engine cycles, charge motion within the cylinder, combustion in spark ignition engines combustion in compression ignition engines, engine heat transfer.

ME 528 Biomechanical Modeling (3-0)3
Mechanics of a particle, a system of particle, a rigid body and of systems of rigid bodies as applied to human movement. Biomechanics as an interdisciplinary subject. Synthesis of Human movement, Muscle mechanics.

ME 529 Advanced Int. Comb. Engine Des. (3-0)3
Engine types and their operation, engine design and operating parameters, gas exchange processes, spark ignition engine fuel metering and monifold phenomena, engine friction and lubrication, engine operating parameters, modelling real engine flow and combustion processes

ME 530 Designing for Production (3-0)3
General review of design principles. Conditions of accuracy based on functional requirements. The effect of manufacturing inaccuracies on theoretical calculations. Rating of materials as regards manufacturing properties. Consideration of design details to facilitate machining.

ME 531 Machine Tool Design (3-0)3
Basic criteria in the design of metal removing machine tools. The design criteria of the main components of machine tools. Design of special mass production machine tools. Testing procedures of machine tools. Model and similarity studies in machine tools.

ME 532 Dynamics of Metal Removing and Machine Tools (3-0)3
Dynamics characteristics of machine tools in single, two-degree vibrations. Mode coupling. Dynamics of metal removing. Stability criteria of machine tool structures. Stabilities in hydrostatic slide-ways

ME 533 Machining Science and App. (3-0)3
Mechanics of metal cutting, Effect of Machining operations on the physical properties of work Materials, Dimensional analysis of metal cutting relations, tool geometry, tool life and cutting speed. The extended cutting speed law. The elementary cutting force law. The extended cutting force law. Cutting power and metal removal rate. Productivity.

ME 534 Intelligent Man. Systems (3-0)3
Manufacturing systems. System components and architecture. Flexible machining and assembly systems. Components of knowledge based systems. Machine learning. Neural networks. Process Planning. Product information modeling and exchange. Knowledge-based systems for equipment selection. Knowledge-based systems for group technology. Knowledge-based systems
for machine layout. Scheduling in automated manufacturing. Group technology. Knowledge-based systems for machine layout. Scheduling in automated manufacturing.

ME 535 Cost Reduction in Eng. Design (3-0)3
Engineering concepts of efficient design, mathematical methods in cost reduction, economic factors influencing design, use of minimum, material based on strength, use of integral design with multifunctional materials use of different manufacturing methods and materials, methods of simplifying assembly

ME 536 Viscoelasticity (3-0)3
Introduction. Definitions. Tensor notation in linear elasticity. Heaviside step function and Dirac delta function. Linear Viscoelasticity: Constitutive equations, time operator representations, integral representations. Mechanical models, Maxwell and Kelvin models, generalized models, Constitutive equations under combined loadings. Viscoelastic response under combined loadings: creep compliance and relaxation modulus, damping. Non-linear viscoelasticity. Kernel function. Stress analysis in viscoelastic materials, bending and torsion. Viscoelastic behaviour of some engineering materials, metals at high temperature, plastics

DESCRIPTION OF GRADUATE COURSES

ME 537 Numerical Methods in Eng. (3-0)3
Solution methods for non-linear algebraic equations, sets of linear algebraic equations, eigen value problems, interpolation and curve fitting, numerical integration, numerical differentiation, and ordinary differential equations. Solution of problems in mechanics, thermal sciences, automatic control systems, kinematic and design.

ME 538 Aerospace Man. Methods (3-0)3
Introduction to aerospace manufacturing industry, modern manufacturing processes, basic principles of aerospace manufacturing, principles of design for aerospace manufacturing, process planning in aerospace manufacturing, material requirement in aerospace manufacturing, handling, manufacturing system automation, intelligent methods for aerospace manufacturing, monitoring, material control and inspection**.**

ME 539 Surface Science and Eng. (3-0)3
Introduction to surface science and engineering. Overview of failure types (wear, fatigue, corrosion) due to surface defects, material properties and environmental factors, Typical surface treatment techniques (carburizing, nitriding, induction, hardening, etc.)Special surface enhancement methods such as shot peening, laser shock peening, burnishing and deep cold rolling. Use of ultrasound on surface enhancement. Effects of surface modification on surface topography, micro-hardness and near-surface residual stresses. Industrial applications of such techniques.

ME 540 Heat Treatment (3-0)3
Basic constituents of metals and alloys. Equilibrium and non-equilibrium cooling with the resulting phases. Manipulation of the shape, size and distribution of micro constituents by heat treatment. The change in the mechanical properties after different heat treatment cycles in relation to the microstructure. Engineering heat treatment techniques.

ME 541 Powder Metallurgy Processing (3-0)3
Principles of P/M processes. Metal powder production methods. Compaction and sintering processes. Deformation processing of sintered powder materials, plasticity theory related to porous materials. Application of P/M, tool materials, bearing materials, friction materials, metallic filters and full density machine components.

ME 542 Theory of Plasticity (3-0)3
Invariant of the stress tensor, and formulation of yield criteria stress-strain relationship in the plastic range. Plastic anisotropy and instability. Empirical strain hardening relationship and experimental methods to obtain them. Hot and cold rolling of strip materials. Extrusion, wire drawing and deep drawing. Introduction to Sliplane Field Theory. Numerical solutions of selected problems. Laboratory experiments covering above processes.

ME 543 Theory of Elasticity (3-0)3
Analysisof stress and strain. Constitutive equations. Plane problems of elasticity. Torsion and flexure of beams. Variational methods. Theorems of minimum potential energy and complimentary energy. Approximate solution by means of variational methods. Introduction to plate theory.

ME 544 Computer Aided Design of Metal Forming Dies (3-0)3
General design requirements. Design of die components. Application of CAD/CAM methods to forming dies. Finite Element Modeling of die components. Methods for forming load prediction.

ME 545 Advanced Thermodynamics I (3-0)3
Foundations of concepts and principles of thermostatic. Second law analysis of engineering systems. Kinetic theory of gases. Constitutive equations, property relations and their applications to compressible systems. Surface phenomena, elastic solid, non-reactive mixtures, chemical reactions, and thermodynamic stability.

ME 546 Advanced Thermodynamics II (3-0)3
The first and second laws of thermodynamics combined. Destruction of exergy. Single phase systems. Exergy generalized. Multiphase systems. The Third Law of Thermodynamics. Power generation. Solar Power. Refrigeration. Thermodynamic design. Irreversible thermodynamics.

ME 547 Lie Group Analysis for Mechanical Vibrations (3-0)3
Dimensional analysis, modeling, invariance**,** Lie groups of transformation and infinitesimal transformation, ordinary differential equations, partial differential equations, Noether's theorem and Lie-Backlund Symmetries, Construction of mappings relating differential equations, potential symmetries.

ME 548 Introduction to Perturbation Analysis for Mechanical Vibrations (3-0)3
Many of the problems facing physicists, engineers, and applied mathematicians involve such difficulties as nonlinear governing equations, variable coefficients, and nonlinear boundary conditions at complex known or unknown boundaries that preclude solving them exactly. Consequently, solutions are approximated using numerical techniques, analytic techniques, and combinations of both. Foremost among the analytic techniques are the systematic methods of perturbations in terms of a small or a large parameter of coordinate.

DESCRIPTION OF GRADUATE COURSES

ME 549 Experimental Stress Analysis I (3-0)3
General principles governing the approach to the solution of problems. Fundamental concepts of stress and strain in 2-D and 3-D. Mechanical and electrical strain gauges, strain rosettes.

ME 550 Experimental Stress Analysis II (3-0)3
Photoelasticity. 2-D and 3-D analysis. Stress freezing, scattered ray and brittle coating techniques. Moire fringes, brittle coatings, grid methods, analogies and their applications on static and dynamic problems

ME 551 Digital Control I (3-0)3
Microprocessor basics. Discrete time signals, signal approximation and reconstruction. Z transforms, manipulation of block diagrams, difference equations

ME 552 Digital Control II (3-0)3
Digital control algorithms, Design methods by digital and continuous modeling, feed forward and cascade control, on-off control, choice of sampling interval, oscillations in the interval, oscillations in the control loop D/A and A/D conversion, multiplexer timing, parallel and serial interfacing, state variable techniques, self-tuning, adaptive and model reference control.

ME 553 Advanced Engineering Measurement (3-0)3
Measurement science, measurement errors and uncertainty, dynamic behavior of measurement systems, statistical analysis of data, signal conditioning (analogue and digital), data acquisition systems, measurement of thermal quantities, measurement of mechanical quantities, imaging instruments-digital image processing, case studies.

ME 554 Nonlinear Vibrations (3-0)3
The course will discuss conservative and non-conservative single degree of freedom systems, forced oscillations, parametrically excited systems, system having finite degrees of freedom, continuous systems and travelling waves having quadratic and cubic nonlinearities and also having integral type nonlinearities which highly represent real system behaviors.

ME 555 Management of Organizations (3-0)3
The focus in this course is on the entire process of management. The major points of analysis are those of organizational design, planning, control, staffing and directing, together with concepts of problem identification, choice and implementation of organizational decisions and theories of comparative organization

ME 556 Advanced Topics Facilities Layout and Location (3-0)3
Optimization and heurist techniques of layout and location analysis, location theory and models. Systematic layout planning. Quantitative analysis for plant layout, common problems in layout, material handling, storage, line balancing etc. Special topics such as design of non-manufacturing facilities. Warehouse automation.

ME 557 Computer Applications to Industrial Problems (3-0)3
Computer application to industrial engineering problems such as forecasting, production inventory planning, sequencing scheduling, project scheduling, of balance, equipment requirement maintenance planning, linear optimization, breakeven analysis, economics order quantity. Term project on computer applications.

ME 558 Quality Planning and Analysis (3-0)3
Basic concepts, Quality costs, Quality improvement (management and operator controllable defects, motivation for quality), Vendor relations. Process control concepts, Process control techniques, Customer relations, Product safety and liability, Quality assurance, Organization for quality, Quality information systems

ME 559 Advanced Operation Research for Engineers (3-0)3
Dynamic programming Characteristics of dynamic programming problems, deterministic dynamic programming Integer programming, Same perspectives on solving integer programming problems, The branch and bound technique, mixed integer programming, zero one integer programming. Non-linear programming, types of non-linear programming problems, classical optimization, the Karush-Kuhn-tucker conditions for constrained optimization, geometric programming, quadratic programming, and separable programming. Scheduling and sequencing.

ME 560 Tribology (3-0)3
Friction of dry surfaces. Nature of frictional interface and theories of friction. The interface temperature and oxide formulation during unlubricated sliding. Mechanism of wear, wear measurement. Properties of lubricants. Solid film lubrication. Concept of viscosity and equation for variation with temperature and pressure. Hydrodynamics of lubrication. Reynold equation. Types and selection of bearings. Design procedure and performance evaluation of bearings. Hydrostatic bearing design. Energy equation and effective viscosity concepts. Rolling friction. Elasto hydrodynamic lubrication. Extreme pressure lubrication in metal forming processes.

DESCRIPTION OF GRADUATE COURSES

ME 561 Principles of CAD/CAM I (3-0)3
General design principles. Statement of the problem, analysis of the problem, alternative searching, decision making. Use of computers in the evaluation computer graphics. Computer simulation techniques.

ME 562 Principles of CAD/CAM II (3-0)3
Further examples of CAD/CAM techniques. Project involving CAD/CAM applications

ME 563 Advanced Heat Conduction II (3-0)3
Applications of integral transform techniques to heat conduction problems. Complex Temperature and complex integral transforms. Laplace transform and solutions by the inversion theorem.

ME 564 Advanced Heat Convection II (3-0)3
Free convection boundary layers. Heat-exchanger analysis and design. Compact heat-exchanger surfaces. Mass transfer.

ME 565 Advanced Thermal Radiation II (3-0)3
Equation of radiative transfer in participating media. Radiative properties of molecular gasses. Radiative properties of particulate media. Exact solutions for one-dimensional grey media. Approximate solutions for one-dimensional media. The method of spherical harmonics. Treatment of non-grey extinction coefficients.

ME 566 Mechatronic System Design (3-0)3
Problem solving and decision making. Introduction to mechatronic concepts, Mechatronic systems and components. Theory and practice of hardware and software interfacing of microprocessors with analog and digital sensor/actuators Design optimization. Economic decision making and cost evaluation. Term mechatronic design projects, manufacturing mechatronic products compatible with project reports, and their performance tests in a design contest.

ME 567 Fracture Mechanics (3-0)3
The need for Fracture Mechanics Fracture Mechanics vs. Strength of Materials in analysis of engineering components. Elastic stress/strain field in continuous medium. Elastic crack tip stress field. Stress intensity factors for practical geometries. Analysis of crack tip plastic zone. Plane stress vs. Plane strain fracture toughness. Energy methods. Environment assisted cracking. Cyclic stress and strain fatigue. Fatigue crack growth. Computational fracture mechanics using FEM and application to design.

ME 568 Exergy Anal. And Thermoeconomics (3-0) 3
Fundamental Energy and Exergy Concepts. Exergy Analysis Methods. Exergy Analyses of Different Systems and Processes. Exergy Analyses of Real Systems: Actual Case Studies. Exergy and Sustainable Development. Exergetic Life Cycle Analysis. Exergy and Industrial Ecology. Exergoeconomic Analysis of Thermal Systems. Economic Aspects of Exergy. Energy and Exergy Prices. Thermoeconomics and Cost Functions. Exergy Economic Accounting. Exergy Economic Analysis of Industrial Processes.

ME 569 Mech. of Composite Materials (3-0)3
Elements of composite materials; metal-matrix composites, laminated composites natural composites, mechanical properties of composites, strength of composites, analysis methods of composites, applications and of composites materials to various areas.

ME 570 Reverse Engineering Application (3-0)3
Contact and noncontact measuring methods, point cloud, surface generation and modeling, product design techniques in reverse engineering, product development, rapid prototyping and CNC production, design for robustness.

ME 571 Non Traditional Manufacturing Processes (3-0)3
Classification of non-traditional production (machining and forming) processes. Chemical Machining, Electro-Chemical Machining(ECM), Electric Discharge Machining(EDM), Abrasive Jet Machining (AJM), Abrasive Flow Machining(AFM) Ultrasonic Machining (USM), Explosive forming, Electro-magnetic forming. Laser Beam Machinery (LBM), Electron Beam Machinery (EBM), Plasma Arc Machining (PAM), Other non-traditional production processes.

ME 572 Energy-Environment Interaction and Sustainability (3-0) 3
Sustainability Concept. Environment, Economy and Social Sustainability. Topics Provoking Awareness in Energy Policy Making. Current and Near Future Energy Production Technologies. Centralized and Decentralized Energy Production Systems. Environmental Protection Laws and Regulations. Side Products in Energy Production and Their Minimization: Gaseous and Particulate Matter Emissions. Local Problems Generated by Side Products. Side Product Cycles and Their Elimination Rate in Nature. Source-Sink Equilibrium. Zero Discharge Concept. Sustainable Energy Production Processes. Turkish Energy Sector and Environment Protection Applications in Turkey. Technological, Economical and Social Factors, and Related Problems

DESCRIPTION OF GRADUATE COURSES

ME 573 Comp. Aided Metal Working I (3-0)3
Computer Aided Analysis of bulk metal forming processes: Forging (hot, cold, warm, isothermal, open-die, enclosed-die), extrusion (direct, indirect, impact) rolling (flat, shape, wedge), wire and bar drawing.

ME574 Comp. Aided Metal Working II (3-0)3
Computer Aided Analysis of sheet metal forming processes: Cutting operations (shearing, blanking, piercing),bending and deep drawing.

ME 576 Energy Methods in Mechanics (3-0)3
3-D stress state 3-D strain state. Virtual work principle. Betti-Maxwell reciprocity theory. Influnce coefficients. Castigliano theorem. Total potiantial energy principle. Complementary energy principle. Generalized and stationary variational principles, Galerkin and Rayleigh- Ritz methods, structural applications

ME 577 Advanced Eng. Mathematics (3-0) 3
First-Order Differential Equations, Second-Order Linear Differential Equations, Higher-Order Linear Differential Equations, Method of Undetermined Coefficients, Method of Variation of Parameters, Series Solutions of Differential Equations (SSDEs). Special Functions; Legendre's Equations, Bessel's Equation, Sturm-Liouville Problems, Orthogonality, Eigenfunction Expansions, Laplace Transforms and Applications. Linear Algebra: Matrices, Vectors, Determinants, Linear Systems of Equations, Gauss Elimination, Eigenvalues, Eigenvectors, Grad, Div, Curl. Fourier Analysis: Series, Integrals, and Transforms. Partial Differential Equations.

ME 580 Finite Elements Analysis (3-0)3
Finite element concept. Variational methods and element formulation techniques. Representation of element behaviour function and geometry. Transformation, assembly and solution procedures. Some applications of finite elements.

ME 581 Boundary Element Analysis (3-0)3
Boundary element concept. Weighted residual methods. Interpolations and element derivations. Potential problems. Elasticity problems. Two dimensional elasticity. Programming concepts.

ME 582 Turbulence (3-0)3
General introduction and concepts. Principles of methods and techniques in the measurement of turbulent flows. Isotropic turbulence. Homogeneous, shear-flow turbulence. Transport processes in turbulent flows. Free turbulent shear flows. "Wall" Turbulent shear flows.

ME 585 Meshlees Methods in Solid Mechanics (3-0)3
Basic definitions. Overview of meshless methods in solid mechanics, Principles for weak forms, Meshless shape function construction. Element free Galerkin method, Meshless Local Petrov-Galerkin method, Point interpolation methods.

ME 598 (M.S.) Research and Thesis (Non-credit)
Compulsory and technical elective courses for thermal and fluid sciences and mechanics and design groups are announced at the beginning of the semester

ME 599 (M.S.) Research and Thesis (Non-credit)
Compulsory and technical elective courses for thermal and fluid sciences and mechanics and design groups are announced at the beginning of the semester.

ME 698 (Ph.D.) Research and Thesis
Program of research leading to Ph.D. degree arranged between student and a faculty member. Students register to this course in all semesters starting from their third semester at the latest while the research program or write-up of thesis is in progress

ME 699 (Ph.D.) Research and Thesi (Non-credit)
Program of research leading to Ph.D. degree arranged between student and a faculty member. Students register to this course in all semesters starting from their third semester at the latest while the research program or write-up of thesis is in progress.

ME 701-750 Graduate Seminar(2-0)(Non-credit)
Directed study and research for Masters level graduate students on a subject of mutual interest to student and faculty member. Course content will depend on interests of the student and faculty member. A paper is to be prepared and presented by the enrolled graduate student at the end of the semester.

ME 751-799 Graduation Project (3-0) (Non-credit)
A one-semester experimental and/or theoretical research project supervised by a faculty member. The project topic is determined by the adviser and the student. A written final report is required at the end the semester.

DESCRIPTION OF GRADUATE COURSES

ME 801-899 Special Studies (Non-credit)
This special studies course designed to introduce M.S. level students to topics of contemporary importance or special interest that falls outside the scope of the curriculum. Supervisor discusses problems related to individuals M.S. level work and guides M.S. level students to generate new ideas in their particular research areas. The course is aimed to enhance research and interchange state-of-the-art information in technological and scientific fields

ME 901-999 Special Topics(4-0) (Non-credit)
This special studies course designed to introduce Ph.D. level students to topics of contemporary importance or special interest that falls outside the scope of the curriculum. Supervisor discusses problems related to individuals Ph.D. level work and guides Ph.D. level students to generate new ideas in their particular research areas. The course is aimed to enhance research and interchange state-of-the-art information in technological
and scientific fields.

(4-0)