Curriculum for M.Tech

Mechanical Engineering with Specialization in Intelligent Mechanical Systems Design

From The Academic Year 2025

(Approved in Senate 61)

Indian Institute of Information Technology Design and Manufacturing, Kancheepuram

Chennai-600 127

Semester 1					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCC	Data Science	3	0	2	4
PCC	Multibody System Dynamics	3	1	0	4
PCC	Engineering Design with Advanced Materials	3	1	0	4
PCC	Multibody System Dynamics Practice	0	0	4	2
PCC	Structural Analysis and Design Optimization	3	1	0	4
PEC	Program Elective Course 1	3	1	0	4
					22
Semester 2					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCC	Intelligent Robotic Systems	3	1	0	4
PCC	Intelligent Robotic Systems Practice	0	0	4	2
PCC	Simulation of Mechanical Structures	0	1	2	2
PEC	Program Elective Course 2	3	1	0	4
PEC	Program Elective Course 3	3	1	0	4
PEC	Program Elective Course 4	3	1	0	4
PEC	Program Elective Course 5	3	1	0	4
					24
Summer					
PCD	M Tech Dissertation (MTD) Phase I	0	0	8	4
					4
Semester 3					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCD	M Tech Dissertation (MTD) Phase II	0	0	24	12
					12
Semester 4					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCD	M Tech Dissertation (MTD) Phase III	0	0	28	14
	Total				**76**

Semester wise Credit Distribution	**Credits**						
Category	**S1**	**S2**	**Summer**	**S3**	**S4**	**Total**	**%**
Program Core Course (PCC)	18	8	0	0	0	26	34.2
Program Elective Course (PEC)	4	16	0	0	0	20	26.3
Professional Career Development (PCD)	0	0	4	12	14	30	39.5
Total	22	24	4	12	14	76	100
Cumulative Credits	**22**	**46**	**50**	**62**	**76**	**76**	

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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Data Science</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">M.Tech: ME(IMSD)/ME (SM)</td><td>Type</td><td colspan="2">Core ▬</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="2">New ▬</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">This course covers the basic concepts of Data Science to help the student to learn, understand and practice data analytics encompassing concepts from descriptive, inferential statistics and predictive techniques and big data concepts.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Ability to identify the characteristics of datasets
• Ability to select and implement machine learning techniques suitable for the respective application
• Ability to solve problems associated with big data characteristics such as high dimensionality
• Ability to integrate machine learning libraries and mathematical and statistical tools</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to data science and relevant industry applications in the field of mechanical engineering; quick review of essential mathematics (linear algebra, statistics and probability), introduction to programming platforms (Python, TensorFlow and R) (L6 + P2)
Databases and management: data preprocessing; data cleaning; data exploration; data wrangling; introduction to relational databases (SQL), NoSQL databases (L8 + P4)
Descriptive Statistics: Data visualization & interpretation; measures of central tendency & dispersion; basic and advanced plots; merits & demerits of Interpretation (L7 + P4)
Inferential Statistics: Hypothesis testing; tests of significance; analysis of variance; introduction to regression (L6 + P4)
Predictive Analytics (concept of machine learning): Supervised and unsupervised; association rules, classification, clustering, outlier analysis, time series modelling (L12 + P10)
Big Data Characteristics: Map reduce; deduplication; distributed storage, implementation using Hadoop/Pyspark platforms (L3 + P4)
Term project related to mechanical engineering applications may be pursued throughout the semester along with the regular lab practice. Term project may be discussed during the lab hours</td></tr>
<tr><td>Text Books</td><td colspan="6">1. J Han, J Pei, and H Tong, Data Mining Concepts and Techniques, Elsevier, 4th Edition, 2022 (ISBN: 9780128117606)
2. J Grus, Data Science from Scratch, O'Reilly Media, Inc. 2nd Edition, 2019 (ISBN: 9781492041139)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. P Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017 (ISBN: 9781491952962)
2. A Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly Media, 2022 (ISBN: 1098125975)
3. J Leskovec, A Rajaraman, and J D Ullman, Mining of Massive Data Sets, Cambridge University Press, Open-source free version, 3rd edition, 2014 (ISBN: 9781316147313)</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Multibody System Dynamics</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">DD: ME(AIR) / M.Tech: ME (IMSD)</td><td>Type</td><td colspan="2">Core ■</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To understand and apply rigid body transformations, orientation parameterizations, and configuration space concepts in multibody dynamics.
• To formulate and analyze equations of motion for constrained mechanical systems
• To develop skills in numerical simulation of multibody systems, including constraint enforcement.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Upon completion of the course, students will be able to:
• Model and analyze multibody systems using configuration space, DoF analysis, and recursive kinematic formulations.
• Formulate and solve constrained dynamic models and implement stabilization techniques for simulation.
• Apply simulation techniques to interpret dynamic behavior in real-world systems.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Rigid body transformations, Orientation parametrization, Degrees of Freedom (DoF) and constraints in mechanical systems. Configuration space and its importance in multibody dynamics. (L8+T2)

Relative motion and angular velocity for a spatial rigid body. Recursive method for velocity and acceleration analysis of spatial mechanisms. Velocity ellipsoids and its role in motion analysis and constraint formulation. (L8+T2)

Generalized coordinates, constraint classification (holonomic, non-holonomic), Principle of virtual work, Generalized forces, Euler-Lagrange formulation, Modeling conservative and nonconservative forces. (L10+T3)

Constraint enforcement using Lagrange multipliers, Differential-Algebraic Equations (DAEs) in constrained multibody systems, stabilization techniques, Simulation of spatial multibody dynamics using numerical solvers. (L8+T4)

Free and forced responses in multibody systems, Linearization of equations of motion, Case studies: four-bar linkages, vehicle suspension systems, cart-pole system, robotic manipulators. (L8+T3)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. A. A. Shabana, Dynamics of Multibody Systems, 4th Edition, Cambridge University Press, 2013. ISBN: 9781107655807
2. K. M. Lynch and F. C. Park, Modern robotics: Mechanics, planning, and control, Cambridge University Press, 2017. ISBN: 9781107156302.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. R. L. Norton, Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, 6th Edition, McGraw-Hill Education, 2019. ISBN: 9781260113310.
2. A. Ghosh and A. K. Mallik, Theory of Mechanisms and Machines, 3rd Edition, Affiliated East-West Press, 2020. ISBN: 9788185938936.
3. H. Baruh, Applied Dynamics, 1st Edition, CRC Press, 2014. ISBN: 9781482250732.</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Engineering Design with Advanced Materials</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
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<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">This course is proposed to offer
• an understanding of mechanical behavior of various advanced materials
• advanced methodologies for selection of materials in engineering design
• the constitutive (phenomenological) models and design methods</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">After the completion of the course, students will be able:
• to correlate the methodologies of engineering design and selection of materials and select right kind of material and process.
• to implement engineering design methodologies in product / component design in real time applications.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Engineering design: Conventional engineering design - Process models, Descriptive and Prescriptive methodologies; Selection of materials and manufacturing process in engineering design - Analysis of material performance requirements, Screening methods, Computer aided material and process selection; AI assisted generative engineering design. (L10+T2)
Advanced engineering materials: Classification; Properties and Applications of Advanced high strength steels and cast irons, Aluminum, Titanium, Nickel, and Magnesium alloys, Engineering ceramics, Engineering and high performance polymers, polymer blends, copolymers, and, Polymer, Metal, Ceramic, and Carbon-Carbon composites. (L8+T2)
Engineering design with time dependent materials: Deformation mechanisms; Constitutive models for viscous and creep behavior; Design with polymers, and, isotropic polymer composites, and high temperature materials; Case studies (L12+T5)
Engineering design with anisotropic materials: Constitutive equations for anisotropic materials and composites; Design with laminated polymer composites; AI enabled laminated polymer composite design; Case studies. (L12+T5)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. R. J Crawford, Plastics Engineering, 3rd edition, Butterworth-Heinmann, 2006, ISBN: 978-81-312-0174-9.
2. A. K. Kaw, Mechanics of Composite Materials, 2nd edition, Taylor and Francis, 2006, ISBN-13: 978-1498767507</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. G. E. Dieter, Engineering Design: Materials and Processing Approach, McGraw-Hill,1999, ISBN-13: 978-0070168961
2. M. F. Ashby, Materials Selection in Mechanical Design, Butterworth Heinemann, 2016, ISBN: 978-0081005996.
3. M. M. Farag, Materials and Process Selection for Engineering Design, 3rd edition, CRC Press, 2014, ISBN-13: 978-0367438340
4. J. C. Gerdeen and R. A. L. Rorrer, Engineering Design with Polymers and Composites, CRC Press, 2nd edition, 2012, ISBN-13: 978-1-4398-6053-3</td></tr>
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<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Multibody System Dynamics Lab</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">DD: ME(AIR) / M.Tech: ME (IMSD)</td><td>Type</td><td colspan="2">Core ☑</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="2">New ☑</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To understand and apply spatial transformations and velocity mappings
• To gain exposure to simulation tools and numerical methods for solving equations of motion in multibody systems</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Upon completion of the course, students will be able to:
• Visualize and interpret rigid body motion using transformations
• Model and simulate open and closed-chain multibody systems
• Solve equations of motion and analyze the behavior of complex systems through simulation</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Visualization of 3D transformations using transformation matrices, orientation representations, and velocity mapping between frames (P8)

Introduction to simulation tools, and modeling of simple rigid body systems (P12)

Modeling and simulation of open- and closed-chain mechanisms, including constraint formulation and enforcement (P12)

Solving equations of motion using various numerical integrators and analyzing accuracy, stability, and constraint satisfaction (P12)

Comprehensive modeling and simulation of complex systems: robotic arms, suspension systems, closed-loop manipulators (P12)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. User manuals and documentation of commercial software and open-source libraries/solvers.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. A. A. Shabana, Dynamics of Multibody Systems, 4th Edition, Cambridge University Press, 2013. ISBN: 9781107655807
2. K. M. Lynch and F. C. Park, Modern robotics: Mechanics, planning, and control. Cambridge University Press, 2017. ISBN: 9781107156302.
3. R. L. Norton, Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines. 6th Edition, McGraw-Hill Education, 2019. ISBN: 9781260113310.
4. A. Ghosh and A. K. Mallik, Theory of Mechanisms and Machines. 3rd Edition, Affiliated East-West Press, 2020. ISBN: 9788185938936.</td></tr>
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<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Structural Analysis and Design Optimization</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">M.Tech: ME (IMSD)</td><td>Type</td><td colspan="2">Core ■</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">This course is intended to present
• the concepts of structural and computational models
• finite element formulation for linear static analysis of 1D, 2D and 3D structures
• basic methodologies of mathematical design optimization</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">After the completion of the course, students will be able to
• analyze mechanical components and structural parts in automotive, naval and aerospace engineering.
• to implement three basic classes of structural optimization methods, i.e., size, shape and topology optimization.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction: Fundamental assumptions and classification of structural members and loads, Structural model, Finite element method, Computational models of structures, Matrix analysis of discrete structures, Principle of virtual work, Principle of minimum total potential energy, structural analysis process with finite elements, Role of structural optimization in design process, Mathematical form of a structural optimization, Types of structural optimization, Discrete and distributed parameter systems. (L6+T2)
Finite element structural analysis: Finite element formulation and hands on solution for simplest axially loaded members and truss structures using two-noded isoparametric elements; Gaussian Quadrature; Finite element formulation and programmed solution for simple plane stress, plane strain and axisymmetric solids using three-noded triangle and four-noded quadrilateral isoparametric elments; Finite element formulation for simplest solid components using four-noded tetrahdedron and eight-noded tetrahedral isoparametric elements. (L14+T6)
Basics and Size optimization: Unconstrained and constrained optimization, Optimization of discrete parameter systems, Basics of convex programming, Sequential Explicit, Convex approximations, Sizing stiffness optimization of a truss, Sensitivity analysis for bars. (L10+T2)
Two dimensional shape optimization: Shape representation and design constraints, sensitivity analysis for two dimensional shape optimization. (L6+T2)
Topology optimization: Stiffness optimization of distributed parameter systems, Homogenization and density based methods, Power and material interpolation laws, Solid Isotropic Material with Penalization (SIMP) approach; Case studies. (L6+T2)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. E. Onate, Structural analysis with finite element method. Linear statics. Volume 1. Basis and Solids, 1st edition, Springer, 2009, ISBN: 978-1-4020-8732-5.
2. P. W. Christensen and A. Klarbring, An introduction to structural optimization, 1st edition, Springer, 2009, ISBN: 981-1-4020-8665-6.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. F. Hartmann and C. Katz, Structural analysis with finite elements, 2nd edition, Springer, 2007, ISBN-13: 978-3-540-49698-4
2. R. T. Haftka and Z. Gurdal, Elements of structural optimization, 3rd edition, Springer, 1992, ISBN: 978-0-7923-1505-6.</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Intelligent Robotic Systems</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">DD: ME(AIR) /
M.Tech: ME (IMSD)</td><td>Type</td><td colspan="2">Core ■</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To develop an understanding of optimal and vision-based control methods for robotic systems.
• To familiarize students with system identification techniques and their role in data-driven control.
• To explore neural network-based control architectures and methods for learning forward and inverse dynamics.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Upon completion of the course, students will be able to:
• Understand and apply optimization and vision based control methods to solve complex control problems.
• Gain expertise in applying system identification techniques and learning-based control architectures, enabling data-driven control in robotics.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Review of robot dynamics using Lagrangian formulation, Jacobian matrix: velocity and force interpretation, Joint motion control, inverse dynamics control, Task-space motion control, including resolved-rate motion control, Impedance control. (L10 + T3)

Basics of constrained optimization and numerical solvers, Quadratic programming and nonlinear programming and their applications to robot control, Redundancy resolution strategies using optimization. (L8 + T2)

Introduction to optimal control and regularization, Numerical integration methods and stability considerations, Direct methods: single shooting, multiple shooting, collocation techniques. (L8 + T3)

Concepts in image formation, camera parameters, Image and position-based visual servoing, feature extraction, tracking and perception pipelines, integration of visual feedback in control. (L6 + T3)

System identification: linear and nonlinear approaches, architecture and training of neural networks (gradient descent, backpropagation), Neural network-based modeling of forward and inverse dynamics, Data-driven control: model-based and model-free, overview of sim-to-real transfer. (L10 + T3)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. S. L. Brunton and J. N. Kutz, Data-Driven Science and Engineering: Machine Learning, Dynamical Systems, and Control, Cambridge University Press, 2nd Edition, 2022. ISBN: 9781108422093
2. K. M. Lynch and F. C. Park, Modern Robotics: Mechanics, Planning, and Control, Cambridge University Press, 2017. ISBN: 9781107156302</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. P. I. Corke, W. Jachimczyk, and R. Pillat, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer, 3rd Edition, 2023. ISBN: 9783031072611
2. J. T. Betts, Practical Methods for Optimal Control and Estimation Using Nonlinear Programming, SIAM, 3rd Edition, 2020. ISBN: 9781611976182
3. S. M. LaValle, Planning algorithms, Cambridge university press, 2006. ISBN: 9780511546877
4. K. P. Valavanis and G. N. Saridis, Intelligent robotic systems: Theory, Design and Applications, Vol. 182. Springer Science & Business Media, 2012. ISBN: 9780792392507</td></tr>
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<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Intelligent Robotic Systems Lab</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
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<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="2">Submitted for approval</td><td colspan="3">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To enable students to apply advanced control, optimization, and perception techniques in robotic systems.
• To expose students to modern frameworks for robot simulation, control, and learning.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Upon completion of the course, students will be able to:
• Implement and test various control strategies in joint and task space.
• Use learning-based methods for robot modeling and control.
• Utilize a range of robotics tools including middleware, physics engines, vision modules, and data-driven frameworks.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to physics engines for robotic simulation and simulate robot dynamics in a physics based environment (P12)
Implementation of model-free and model based control strategies, and inverse dynamics (P8)
Optimization-based control: constrained motion control, redundancy resolution using Quadratic Programming (P12)
Visual servoing: camera calibration, integrate visual feedback to guide robot motion (P8)
Learning-based robot modelling and control: Collect and preprocess data from simulated or real robots, compare model-based vs. data-driven control performance (P16)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. S. L. Brunton and J. N. Kutz, Data-Driven Science and Engineering: Machine Learning, Dynamical Systems, and Control, Cambridge University Press, 2nd Edition, 2022. ISBN: 9781108422093
2. P. I. Corke, W. Jachimczyk, and R. Pillat, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer, 3rd Edition, 2023. ISBN: 9783031072611</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Simulation of Mechanical Structures</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>0</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">M.Tech: ME (IMSD)</td><td>Type</td><td colspan="2">Core ■</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td>Nil</td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">This course is intended to provide
• finite element solutions for static and dynamic analysis of 1D, 2D and 3D structural models using commercial finite element software.
• basic methodology for intelligent generative design of mechanical structures and machine components.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">After the completion of the course, students will be able to
• analyze and design mechanical components and structural parts in automotive, naval and aerospace engineering.
• to implement intelligent generative design technique for product design.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Application of multiphysics software for simulation of complicated mechanical structures and machine components. (T1+P2)
Static and dynamic structural analysis procedure and application to complex physical components. (T3+P6)
Steady state and transient thermal analysis of mechanical structures and machine components. (T2+P4)
Application of contact elements, nonlinear material models and structural optimization techniques. (T3+P6)
Coupled field finite element analysis of mechanical structures and machine components. (T2+P4)
Intelligent generative design technique for engineering design of products and final evaluation. (T3+P6)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Training and User manuals of commercial software.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. E. Madenci and I. Guven, The Finite element method and applications in engineering using ANSYS, 2nd edition, Springer, 2015, ISBN-13: 978-1-4899-7550-8.
2. G. R. Liu and S. S. Quek, The Finite element method: A practical course, 2nd edition, Butterworth-Heinemann, 2013, ISBN-13: 978-0080983561.
3. J. G. Eisley and A. M. Waas, Analysis of structures. An introduction including numerical methods, 1st edition, Wiley, 2011, ISBN: 9780470977620.</td></tr>
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