Curriculum and Syllabus M.Tech.

Mechanical Engineering With Specialization in Mechanical Systems Design

From The Academic Year 2021

(Approved by Senate-44)

Indian Institute of Information Technology, Design and Manufacturing, Kancheepuram
Chennai-600 127

Semester 1							
S.No	Course Code	Course Name	Category	L	T	P	C
1	ME5000	Advanced Numerical Methods	PCC	3	1	0	4
2	ME5001	Advanced Mechanics of Materials	PCC	3	1	0	4
3	ME5002	Design for Manufacture and Assembly	DSC	3	1	0	4
4		Professional Elective 1	PEC	3	1	0	4
5		Professional Elective2	PEC	3	1	0	4
6	ME5003	Advanced Numerical Methods Practice	PCC	0	0	3	1.5
7	ME5004	Advanced Mechanics of Materials Practice	PCC	0	0	3	1.5
							23.0
Semester 2							
S.No	Course Code	Course Name	Category	L	T	P	C
1	ME5005	Design with Advanced Engineering Materials	PCC	3	1	0	4
2	ME5006	Analysis and Synthesis of Robot Mechanisms	PCC	3	1	0	4
3		Professional Elective 3	PEC	3	1	0	4
4		Professional Elective 4	PEC	3	1	0	4
5		Professional Elective 5	PEC	3	1	0	4
6	ME5007	Analysis and Synthesis of Robot Mechanisms Practice	PCC	0	0	3	1.5
7	ME5008	Advanced Engineering Simulation Practice	PCC	0	0	3	1.5
							23.0
Semester 3							
S.No	Course Code	Course Name	Category	L	T	P	C
1	ME6003	MT-ME-MSD-Project I (May-July) (Summer Internship)	PCD	0	0	20	10
2	ME6004	MT-ME-MSD-Project II (Aug-Nov)	PCD	0	0	32	16
							26.0
Semester 4							
S.No	Course Code	Course Name	Category	L	T	P	C
1	ME6005	MT-ME-MSD-Project III (Dec-April)	PCD	0	0	32	16
							16.0

0

1. Professional Elective Course is an elective course offered or prescribed by the parent department.
2. In line with the guidelines approved by the Senate (Senate 46-07), an M.Tech student can earn a maximum of 6 credits from NPTEL Courses. For all successfully completed NPTEL Courses, the letter grade “H” (Pass) will be awarded and credits of such courses will not be accounted for CGPA calculation.

Semester wise Credit Distribution

	Semester					
Category	S1	S2	S3	S4	Total	%
Professional Core Course (PCC)	11	11	0	0	22	25.0
Design Course (DSC)	4	0	0	0	4	4.5
Professional Elective Course (PEC)	8	12	0	0	20	22.7
Professional Career Development (PCD)	0	0	26	16	42	47.7
Total	23.0	23.0	26.0	16.0	88.0	100.0

<table>
<tr><td>Course Name</td><td>Advanced NumericalMethods</td><td>Course Code</td><td colspan="4">ME5000</td></tr>
<tr><td rowspan="2">Offered by Department</td><td rowspan="2">MechanicalEngineering</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>To be offered for</td><td>M. Tech</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>MathematicsforEngineers</td><td>Approved In</td><td colspan="4">Senate-44</td></tr>
<tr><td>LearningObjectives</td><td colspan="6">Thiscourseprovides
• anintroductiontotheconceptsofLinearAlgebra
• techniquestosolvevariouskindsofequationsthatstudentsencounterinthefieldofengineering.</td></tr>
<tr><td>LearningOutcomes</td><td colspan="6">Atthecompletionofthecourse,thestudentwillbeable
• tounderstand the methodsbywhichphysicalproblems canbe solved usingcomputation.
• tousecomputationintheoreticalanalysisandexperimentaldatainterpretation.</td></tr>
<tr><td>Course Contents (withapproximatebreakupofhours for lecture/tutorial)</td><td colspan="6">• IntroductiontoLinearAlgebra:Vectorspaceandsubspaces,Tensors,LinearTransformation,systemofLinearequationandMatrices,ApplicationsinEngineering(6L+2T)
• SolutionofLinearAlgebraicequations:Gausselimination,Gauss-Jordon,LUDecomposition, QR Method, Jacobi and Gauss-Seidel Methods; Eigenvalues andEigenvectors– Powerandinversepowermethod,physicalinterpretationofeigenvalues and eigenvectors, Regression based on Least Squares and PrincipalComponentAnalysis(8L+3T)
• Solution of Nonlinear Algebraic equations: Bisection method, fixed-point iterationmethod,Newton-Raphson,Secantmethod(6L+2T)
• FinitedifferenceformulausingTaylorseries,DifferentiationofLagrangepolynomials, Simpson's rule, Gauss-quadrature rule, Romberg method, multipleintegrals(6L+2T)
• Solution for ODE – Euler's method and Stability criterion, second order and fourthorderRunge-Kuttamethods,systemofODEsandnonlinearODEs(6L+2T)
• Solution for PDE – Classification of PDEs, Elliptic equations, Parabolic equations(Transientdiffusionequation),Hyperbolicequations(waveequation)(5L+2T)
• Numerical Optimization-Line Search method, Steepest Descent method, ConjugateGradient method, Penalty and Augmented Lagrangian method, Introduction to ANNandGA(5L+1T)</td></tr>
<tr><td>EssentialReading</td><td colspan="6">1. S.P.Venkateshan,PrasannaSwaminathan,ComputationalMethodsinEngineering,Ane Books,1st edition, 2013,ISBN-13: 978-0-12-416702-5.
2. StevenC.Chapra,NumericalMethodsforEngineering,Mc-GrawHillEducation,7theedition,2015,ISBN-13:978-0073397924.</td></tr>
<tr><td>SupplementaryReading</td><td colspan="6">1. GilbertStrang,Introduction to Linear Algebra,Wellsley-Cambridge 2009.
2. JoeDHoffman,StevenFrankel,NumericalMethodsforEngineersandScientists,Second Edition,CRCPress,2001,ISBN-13:978-0824704438.
3. Jain, M.K., Iyengar, S.R., and Jain,R.K., `Numerical Methods for Scientific andEngineeringComputation',NewAgeInternationalPvt.Ltd.,2019,ISBN-13:978-9387477254..
4. EKreszig,AdvancedEngineeringMathematics,JohnWiley,10thedition,2015,
5. ISBN-13:978-8126554232.</td></tr>
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Course Name	Advanced Numerical MethodsPractice	CourseCode	ME5003			
Offered by Department	MechanicalEngineering	Structure(LTPC)	0	0	3	1.5
To be offered for	M.Tech	Course Type	Core			
Prerequisite	ProgrammingusingCorC++	Approved In	Senate-44			
LearningObjectives	Thiscourseprovidesanintroductiontothenumericalmethodstosolvevariouskindsofequations relevant to engineering field that students encounter using programmingtoolslikeCandC++.					
LearningOutcomes	Atthecompletionofthecourse,thestudentwillbeableto • understandtheimportanceofobtainingapproximatesolutionstovariouspractical problems • solve the application-oriented problemsusing C codes orC++ codes					
Course Contents (withapproximatebreakupofhours for lecture/tutorial)	• ExerciseonSolutionforLinearAlgebraicequations:Gauss-Jordon,LUDecomposition,JacobiandGauss-SeidelMethods;EigenvaluesandEigenvectors(9) • ExerciseonSolutionofNonlinearAlgebraicequations:Bisectionmethod,fixed-pointiterationmethod,Newton-Raphson,Secantmethod(6) • ExerciseonFinitedifferenceformulation(6) • ExerciseonSolutionforODE–Euler,secondorderandfourthorderRunge-Kuttamethods,systemofODEsandnonlinearODEs(6) • ExerciseonSolutionforPDE–Ellipticequations,Parabolicequations,Hyperbolicequations(6) • ExerciseonNumericalOptimization–LineSearchmethod,SteepestDescentmethod,ConjugateGradientmethod,IntroductiontoANNandGA(6) • Practicalengineeringproblemsinstructuralandthermalsystems(3)					
EssentialReading	1. S.P.Venkateshan,PrasannaSwaminathan,ComputationalMethodsin Engineering,Ane Books,1st edition, 2013,ISBN-13: 978-0-12-416702-5. 2. StevenC.Chapra,NumericalMethodsforEngineering,Mc-GrawHillEducation,7theedition,2015,ISBN-13:978-0073397924.					
SupplementaryReading	1. JoeDHoffman,StevenFrankel,NumericalMethodsforEngineersandScientists, SecondEdition,CRCPress,2001,ISBN-13:978-0824704438. 2. Jain,M.K.,Iyengar,S.R.,andJain,R.K.,NumericalMethodsforScientificandEngineeringComputation,NewAgeInternationalPvt.Ltd.,2019,ISBN-13:978-9387477254. 3. JorgeNocedal,StephenJ.Wright,NumericalOptimization,SecondEdition, Springer,2006,ISBN-10:0-387-30303-0,ISBN-13:978-0387-30303-1. 4. EKreszig,AdvancedEngineeringMathematics,JohnWiley,10thedition,2015, ISBN-13:978-8126554232.					

Course Name	Advanced Mechanics of Materials	Course Code	ME5001			
Offered by Department	Mechanical Engineering	Structure(LTPC)	3	1	0	4
To be offered for	M.Tech	Course Type	Core			
Prerequisite	Strength of Materials and EnggMechanics	Approved In	Senate-44			
LearningObjectives	Thiscourseisintendedtogivenecessary • understandingofbehaviorofsolidmaterialsintermsoftheirmotionanddeformation undertheactionofstaticforces. • analyticalandnumericalmethodstoanalyzethebehaviorofvariousstructuralmembers.					
LearningOutcomes	Atthecompletionofthecourse,thestudentwillbeableto • Formulatethebehaviorofvariousmechanical structures • Perform stressanalysisofvariousproductsofdifferentshapesmadewithallkindsoflinearelasticmaterials.					
Course Contents (withapproximatebreakupofhours for lecture/tutorial/practice)	• Theoriesofstressandstrain–Principalstressesandstrains,equationsofequilibrium, strain displacement relations, compatibility conditions, and constitutiverelations.***(L9 + T2)*** • Energy methods – elastic strain energy, Theorems of Castigliano, virtual work andstationarypotentialenergy,Applications.***(L6 + T2)*** • Euler-Bernoulli beam bending of asymmetrical sections – bending stresses anddeflection.***(L 3 + T1)*** • Formulation, Analytical and Finite Difference and Finite element solutions – Beamsonelasticfoundation,Torsionofprismaticmembers.***(L 6 +T 3)*** • Formulation and analytical methods of solution of 2D linear elasticity problems –Airy's stress function approach for plane stress and plane strain, displacementfunctionapproach foraxisymmetrically loadedmembers,temperature effects.***(L12 + T 4)*** • Formulation and analytical methods of solution of Plates and shells – Governingequations,Solutionsforsimpleboundaryconditions.***(L6+T 2)***					
EssentialReading	1. L.S.Srinath,AdvancedMechanicsofSolids,TataMcGraw-Hill,1stedition,2009, ISBN:9780070139886. 2. A.C.UguralandS.K.Fenster,AdvancedStrengthandAppliedElasticity,PrenticeHall,5thedition,2013,ISBN-13:978-0-13-707920-9.					
SupplementaryReading	1. S.P.TimoshenkoandJ.N.Goodier,TheoryofElasticity,TataMcGraw-Hill,3rd edition,2013,ISBN-13:978-0-07-070122-9. 2. A.P.BoresiandR.J.Schmidt,AdvancedMechanicsofMaterials,JohnWiley&Sons,Inc.,6thedition,2003,ISBN978-0-471-43881-6. 3. R.G.Budynas,AdvancedstrengthandAppliedStressAnalysis,McGraw-Hill,2ndedition,1999,ISBN:9780070089853.					

Course Name	Advanced Mechanics ofMaterialsPractice	CourseCode	ME5004			
Offered by Department	MechanicalEngineering	Structure(LTP C)	0	0	3	1.5
To be offered for	M.Tech.	Course Type	Core			
Prerequisite	Strength of Materials and EnggMechanics	Approved In	Senate-44			
LearningObjectives	Thiscourseisintendedtogivenecessary • Numericalformulationtopredictstresses,andin-turnlifeofstructures • Simulationofcomplexshapedcomponentstopredictstresses.					
LearningOutcomes	Atthecompletionofthecourse,thestudentwillbeableto • Formulatethebehaviorofvariousstructuralelementsand • Predictthelifeofvariousproductsofdifferentshapesmadewithawidevarietyofmaterials.					
Course Contents (withapproximatebreakupofhours for lecture/tutorial/practice)	• Finite difference solutions for torsion of prismatic bars, beams with varying forcesandcrosssectionalongthespan,beamsonelasticfoundation.***(P9)*** • Finite element solutions for axially and transversely loaded members, thin plates ordiscswithin-planeandlateralforces,longnoncircularpipesanddams,solidflywheel,long(infinite) cylindersandbrackets***(P 21)*** • Basicdynamicproblems***(P6)***					
EssentialReading	1. A.C.UguralandS.K.Fenster,AdvancedStrengthandAppliedElasticity,Prentice Hall,5thedition,2013,ISBN-13:978-0-13-707920-9. 2. T. R. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements inEngineering,Pearson,4thedition,2011,ISBN:978-0132162746.					
SupplementaryReading	1. L.S.Srinath,AdvancedMechanicsofSolids,TataMcGraw-Hill,1stedition,2009, ISBN:9780070139886. 2. A.P.BoresiandR.J.Schmidt,AdvancedMechanicsofMaterials,JohnWiley&Sons,Inc.,6thedition,2003,ISBN978-0-471-43881-6. 3. R.G.Budynas,AdvancedstrengthandAppliedStressAnalysis,McGraw-Hill,2ndedition,1999,ISBN:9780070089853.					

Course Name	Design for Manufacture andAssembly	Course Code	ME5002			
Offered by Department	MechanicalEngineering	Structure(LTPC)	3	1	0	4
To be offered for	M.Tech.	Course Type	Core			
Prerequisite	BasicMaterials&ManufacturingEngineeringCourses	Approved In	Senate-44			
LearningObjectives	• Toprovideunderstandingofinterrelationshipsbetweendesignandmanufacturing • Toexploreimplicationsofearlyselectionofmaterials,shapesandmanufacturingprocessesinaproductdevelopment • Toimpartknowledgeonassemblyconsiderationsandassemblycostevaluations					
LearningOutcomes	Afterthecompletionofthecourse,studentswillbeable: • Tounderstandtheimportanceofconsideringassemblyandmanufacturingchoicesintheearlystagesofproductdesign • Toquantitativelyestimatetheassemblyandmanufacturingcostofaproduct. • Toselectanappropriateassemblysequence,materialandprocessingmethodtoreducethemanufacturingcomplexityandcostofaproduct					
Course Contents (withapproximatebreakupofhours for lecture/tutorial/practice)	• Engineering Design: Linear types, Descriptive and prescriptive models, problemstatement – objectives, constraints and specifications, Concept generation andevaluation,Embodimentanddetaileddesign,Applications.***(L6+T2)*** • Selection of Materials: Connection between engineering design and selection ofmaterials, Material performance requirements, Initial screening, Comparing andrankingalternatives,optimalmaterialselectionbasedonshape,sizeandmanufacturingprocess,Casestudies.***(L8+T3)*** • Process Selection: Review of Manufacturing Processes, Design for Casting, DesignforBulkDeformationProcesses,DesignforSheetMetalFormingProcesses,DesignforMachining,DesignforPowderMetallurgy,DesignforPolymerProcessing,DesignforAdditiveManufacturing,Case-Studies.***(L15+T5)*** • Review of Assembly Processes, Design for Welding, Design for Brazing andSoldering, Design for Adhesive Bonding, Design for Joining of Polymers, Design forHeatTreatment,Case-Studies.***(L5+T1)*** • Designformanualassembly,DesignforPCBManufacturingandassembly,Electrical ConnectionsandWireharnessassembly,DesignforAutomatedandRoboticAssembly,Casestudies.***(L8+ T3)***					
EssentialReading	1. M.F.Ashby,MaterialsSelectioninMechanicalDesign,5thedition,Elsevier,2011.ISBN:9780081005996. 2. M.M.Farag,MaterialsandProcessSelectionforEngineeringDesign,3rdedition,CRCPress,2014,ISBN-13:978-0367438340. 3. P.Dewhurst,W.Knight,G.Boothroyd,ProductDesignforManufactureandAssembly,3rdedition,CRCPress,2010,ISBN:9781420089271. 4. L.C.Schmidt,G.Dieter,EngineeringDesign,4thedition,McGrawHillEducationIndiaPrivateLimited,2013.ISBN:978-1259064852					
SupplementaryReading	1. M.F.Ashby,K.Johnson,MaterialsandDesign:TheArtandScienceofMaterialSelectioninProduct Design,3rdedition,Butterworth-HeinemannLtd,2014.ISBN:978-0080982052. 2. M.F.Ashby,MaterialsandtheEnvironment:Eco-informedMaterialChoice,2ndedition,Butterworth-Heinemann,2012. 3. G.Boothroyd,AssemblyAutomationandProductDesign,2ndedition,CRCPress2005. 4. J.G.Bralla,DesignforManufacturabilityHandbook,2ndedition,McGraw-HillProfessional,1998.ISBN:978-0070071391.					

Course Name	DesignwithAdvancedEngineeringMaterials	Course Code	ME5005			
Offered by Department	MechanicalEngineering	Structure(LTPC)	3	1	0	4
To be offered for	M.Tech	Course Type	Core			
Prerequisite	BasicMaterialsEngineeringCourse	Approved In	Senate-44			
LearningObjectives	Thiscourse is proposedtooffer • theconnectionbetween engineering designand materials • anunderstandingofratedependentandindependentmechanicalbehaviorofvariousadvanced materials • theconstitutive(phenomenological)modelsandsimplifieddesignmethodsforvariousadvanced materialsthatarerequiredfordesignengineers. • theprocessofdesigningadvanced/newmaterialsforvariousproducts/components					
LearningOutcomes	Afterthecompletionofthecourse,studentswillbeable: • tocorrelatethemethodologies ofengineering designand selectionofmaterialsandselectrightkindofmaterialandprocess • tousenecessarymathematical(constitutive)modelsandsimplifiedengineeringdesignmethodologiesinengineeringproduct/componentdesign					
Course Contents (withapproximatebreakupofhours for lecture/tutorial/practice)	• Engineering design process and role of materials: Connection between engineeringdesign and selection of materials, Time independent and dependent mechanicalbehavior of materials, Classification of advanced engineering materials based ontheir properties and applications, Computer aided material and process selection,Applications.***(L 15 + T 5)*** • Designwithratedependentmaterials:Deformationmechanisms,Phenomenological models considering viscous effects, Design with polymers,Fatigueandfractureofpolymers,Casestudies.***(L9+T3)*** • Designwithanisotropicmaterials:Typesofanisotropicmaterials,Constitutiveequationsforanisotropicmaterialsandcomposites,Designwithcompositematerials,Fatigueandfractureofcomposites,Casestudies.***(L12+T4)*** • Designwithhightemperaturematerials:Classificationandcharacteristicsofsuperalloys, Creep and fatigue resistance of super alloys, Design considerations foradvancedceramics,fracturereliability,Casestudies.***(L6+T2)***					
EssentialReading	1. M.F.Ashby,MaterialsSelectioninMechanicalDesign,ButterworthHeinemann,2016,ISBN:978-0081005996. 2. R.JCrawford,PlasticsEngineering,3rdedition,Butterworth-Heinmann,2006,ISBN:978-81-312-0174-9. 3. J.C.GerdeenandR.A.L.Rorrer,EngineeringDesignwithPolymersandComposites, CRCPress,2ndedition,2012,ISBN-13:978-1-4398-6053-3.					
SupplementaryReading	1. G.E.Dieter,EngineeringDesign:MaterialsandProcessingApproach,McGraw-Hill,1999ISBN-13:978-0070168961 2. M.M.Farag,MaterialsandProcessSelectionforEngineeringDesign,3rdedition,CRCPress,2014,ISBN-13:978-0367438340 3. R.C.Reed,TheSuperalloys:FundamentalsandApplications,1st edition,CambridgeUniversityPress,2006,ISBN:9780511541285. 4. D.W.RichersonandW.E.Lee,ModernCeramicEngineering:Properties, ProcessingandUseinDesign,4th edition,CRCPress,2018,ISBN:9780429488245.					

Course Name	Analysis and Synthesis ofRobot Mechanisms	Course Code	ME5006			
Offered by Department	MechanicalEngineering	Structure(LTPC)	3	1	0	4
To be offered for	M.Tech.	Course Type	Core			
Prerequisite	KinematicsandDynamics	Approved In	Senate-44			
LearningObjectives	• To impartadvancedknowledge inanalysisand synthesis ofrobotmechanisms					
LearningOutcomes	Attheendofthecoursestudentwillableto: • Ability to designand analyzeplanar and spatialmechanisms • Abilitytosynthesizevariousmechanisms • Abilitytodesignandanalyzemechanisms for roboticapplications					
CourseContents	• **ReviewofKinematicsofPlanarMechanisms:**Kinematic pairs, chains andmechanisms,kinematicinversions;Velocityandaccelerationofplanarmechanisms-graphical and analytical methods; Loop closure equation; Four-barmechanisms,Grashofcriterion.***(6L+1T)*** • **GraphicalSynthesisofPlanarMechanisms:**Typeandnumbersynthesis;Motion, path and function generation, Chebyshev's accuracy points; Two-three-four position synthesis with and without prescribed timing; Synthesis of dwell andGenevamechanisms.***(8L+2T)*** • **Analytical Synthesis of Planar Mechanisms:** Complex algebra representation;Standard form equation; Two and three position analytical synthesis for motion,path and function generation; Introduction to commercially available software formechanismsynthesis.***(8L+2T)*** • **KinematicsandDynamicsofSerialMechanisms:**Robotkinematics-forward/inverse; Denavit- Hartenberg matrix transformation; Differential motionand Jacobian; Dynamics and position control; Path planning; Applications. ***(12 L+3 T)*** • **SpatialLinkagesandParallelMechanisms**:Rigidbodyandspatialtransformations;Displacement, velocityandaccelerationanalysesofspatiallinkages;Introductiontokinematicanalysisofparallelmechanisms.***(8 L+2T)*** • **CompliantRobotMechanisms**:Flexibilityanddeflection;largedeflectionanalysis;Applications.***(3L+1T)***					
EssentialReading	1. J.J.Uicker,G.R.PennockandJ.E.Shigley,TheoryofMachinesandMechanisms,OxfordUniversityPress,4thedition,2014,ISBN:9780199454167 2. R.L.Norton,DesignofMachinery-AnIntroductiontotheSynthesisandAnalysisofMechanismsandMachines,McGrawHill,6thedition,2020,ISBN:9780077421717 3. CraigJ.J.,"IntroductiontoRobotics:MechanicsandControl,PrenticeHall,4thEdn,2018,ISBN: 9780133489798					
SupplementaryReading	1. A.G.ErdmanandG.N.Sandor,MechanismDesign:AnalysisandSynthesis:Vol.1,Pearson,4thedition,2004,ISBN:9780130408723. 2. A.G.ErdmanandG.N.Sandor,MechanismDesign:AnalysisandSynthesis:Vol.2,Pearson,2005,4thedition,ISBN:9780130114372. 3. K. Russell, Q. Shen and R. S. Sodhi, Mechanism Design: Visual andProgrammable Approaches,CRCPress,1stedition,2014,ISBN:9781466570177. 4. K.S.Fu,R.C.GonzalezandC.S.G.Lee,Robotics:Control,Sensing, Vision,Intelligence,McGraw-Hill Education, 1st edition, 2008, ISBN:9780070265103					

Course Name	Analysis and Synthesis ofRobot MechanismsPractice	Course Code	ME5007			
Offered by Department	MechanicalEngineering	Structure(LTPC)	0	0	3	1.5
To be offered for	M.Tech.	Course Type	Core			
Prerequisite	KinematicsandDynamics	Approved In	Senate-44			
LearningObjectives	• To impartadvancedknowledge inanalysisand synthesis ofrobotmechanisms					
LearningOutcomes	Attheendofthecoursestudentwillableto: • Ability to designand analyzeplanar and spatialmechanisms • Abilitytosynthesizevariousmechanisms • Abilitytodesignandanalyzemechanisms for roboticapplications					
CourseContents	• Design,kinematicanalysisandsynthesisoflinkagesandmechanismsforvariousapplications using free and paid software such as MechAnalyzer, Linkage 3.0,GIMMechanism,AR-CAD,CATIA,ADAMS,AutodeskInventor,MatlabRoboticsToolBox. • Constructionofvariousrobotmechanismsusingrobotkits. • Programmingandvalidationofkinematicsanddynamicsofrobotmanipulators.					
EssentialReading	1. J.J.Uicker,G.R.PennockandJ.E.Shigley,TheoryofMachinesandMechanisms,OxfordUniversityPress,4thedition,2014,ISBN:9780199454167 2. R.L.Norton,DesignofMachinery-AnIntroductiontotheSynthesisandAnalysisofMechanismsandMachines,McGrawHill,6thedition,2020,ISBN:9780077421717 3. CraigJ.J.,"IntroductiontoRobotics:MechanicsandControl,PrenticeHall,4thEdn,2018,ISBN:9780133489798					
SupplementaryReading	7. A.G.ErdmanandG.N.Sandor,MechanismDesign:AnalysisandSynthesis:Vol.1,Pearson,4thedition,2004,ISBN:9780130408723. 8. A.G.ErdmanandG.N.Sandor,MechanismDesign:AnalysisandSynthesis:Vol.2,Pearson,2005,4thedition,ISBN:9780130114372. 9. K.Russell,Q.ShenandR.S.Sodhi,MechanismDesign:VisualandProgrammableApproaches,CRCPress,1stedition,2014,ISBN:9781466570177. 10. K.S.Fu,R.C.GonzalezandC.S.G.Lee,Robotics:Control,Sensing,Vision,Intelligence,McGraw-Hill Education, 1st edition, 2008, ISBN:9780070265103 11. L.W.Tsai,RobotAnalysis:TheMechanicsofSerialandParallelManipulators,Wiley,1stedition,2005,ISBN:9780471325932 12. L.L.Howell,CompliantMechanisms,JohnWiley&Sons,1stedition,2002,ISBN:9780471384786.					

Course Name	Advanced EngineeringSimulation Practice	Course Code	ME5008			
Offered by Department	MechanicalEngineering	Structure(LTP C)	0	0	3	1.5
To be offered for	M.Tech.	Course Type	Core			
Prerequisite	KinematicsandDynamics	Approved In	Senate-44			
LearningObjectives	Toprovidehands-onexperienceinsimulationandanalysisofmechanicalsystemsusingsophisticatedtools.					
LearningOutcomes	Studentswillacquireknowledgenecessaryforproductdesignusingcomputer aidedengineeringtools.					
CourseContents	• ApplicationofFiniteelementmethodusingCAEsoftware. ***(P3)*** • Static and transient structural analysis procedure and application to complexphysicalcomponents***(P9)*** • Steady state and transient thermal analysis of mechanical structuralsystems***(P 9)*** • Analysisprocedureandapplicationofcontactelements,nonlinear materialmodelsandrigidbodydynamics.***(P 9)*** • Coupledfieldfiniteelement analysisofmechanicalstructuralsystems. ***(P6)***					
EssentialReading	1. Usermanualsofsoftwarepackages.					
SupplementaryReading	1. S.Moaveni,FiniteElementAnalysis:TheoryandApplicationwithANSYS,Pearson2013,ISBN-13:978-0133840803					