CMR Institute of Technology, Bangalore		
Department: Mechanical Engineering		
Semester: 01 (M Tech)		
APPLIED MATHEMATICS	16MDE11	Lectures/week: 06
Course Instructor: Prof. K. Meenakshi		
Course duration: Sep 2016 –Dec 2016		

Lesson Plan

Lecture #	Book & Sections	Topics	Portions coverage %	
			Individual	Cumulative
1 - 10	TB1: 1.1 TB1: 1.2 TB1: 1.3 TB1: 1.1	**Approximations and Round off errors**: Significant figures, Accuracy and precision, Error definitions, Round off errors and truncation errors, Mathematical modeling and engineering problem solving, Simple mathematical model, Conservation laws of engineering	**12**	**12**
11 - 25	RB4: 14.4.1 RB4: 14.4.2 RB4: 14.4.3 RB4: 14.5.1 RB4: 14.4.3 RB4: 14.5.2 RB4: 14.5 RB4: TB1: 2.6 RB4: 14.8 RB4: 14.6	**Roots of equations** : Bracketing methods-graphical method, Bisection method, False position method, Newton Raphson method, Secant method, Multiple roots, Simple fixed point iteration. **Roots of polynomial:** Polynomials in engineering and science, Muller's method, Bairstow's method, Graeffe's root squaring method	**22**	**32**
26 - 31	TB1: 5.4.7 RB6: 5.9 TB1: 5.4 TB1: 5.4.6 RB1: 5.10 TB1: 5.4.6	**Numerical differentiation and Numerical Integration** Newton-Cotes and Guass quadrature integration formulae, Integration of equation, Romberg integration, Numerical differentiation applied to engineering problems, High accuracy differentiation formulae	**12**	**44**

	TB1: 5.4.6			
32 - 50	RB4: 15.1 RB4: 15.2.1 RB4: 15.2.3 RB4: 15.2.5 RB4: 15.3.3 RB4: 15.2.2 RB6: 2.5,2.9 TB1: 6.4 RB1: 3.7 RB1: 3.8 RB1: 3.9 RB1: 3.10 RB4: 13.6 RB4: 13.6	System of Linear Algebraic Equations And Eigen Value Problems: Introduction, Direct methods, Cramer's Rule, Gauss Elimination Method, Gauss-Jordan Elimination Method, Triangularization method, Cholesky Method, Partition method, error Analysis for direct methods, Iteration Methods. Eigen values and Eigen Vectors: Bounds on Eigen Values, Jacobi method for symmetric matrices, Givens method for symmetric matrices, Householder's method for symmetric matrices, Rutishauser method for arbitrary matrices, Power method, Inverse power method	**28**	**72**
51 - 65	RB7: 5.1 RB7: 5.2 RB7: 6.1 RB7:6.2 RB7:7.1 RB7:7.2 RB7:7.3 RB8:8.1 RB8:8.2	Linear Transformation: Introduction to Linear Transformation, The matrix of Linear Transformation, Linear Models in Science and Engineering Orthogonality and Least Squares: Inner product, length and orthogonality, orthogonal sets, Orthogonal projections, The Gram-schmidt process, Least Square problems, Inner product spaces	**28**	**100**

Syllabus for Internal Assessment Tests (IAT)*

IAT #	Sylla
T1	1-24
T2	25-42
T3	43-65

Literature:

Book type	Code	Author and title	Publication Info	
			Edition & Publisher	ISBN #
Text Book	TB1	S.S.Sastry, Numerical Analysis for Engineers	Tata Mcgraw Hill edition	**0-87692-611-1**
Text Book	TB2	Steven C.Chapra, Raymond P.Canale Numerical Methods for Engineers,	Fourth edition Tata Mcgraw Hill	--
References	RB1	M.K.Jain,S.R.K Iyengar, R.K.Jain Numerical methods for scientific and engg computation	New Age International Publishers	**81-224-1461-3**
References	RB2	Applications of numerical methods to engineering	Pervez Moin	-
References	RB3	Linear Algebra and its applications	Pearson edition David.C.Lay	--
References	RB4	H.C.Saxena, Finite differences and Numerical Analysis	S.Chand, 15th edition	**81-219-0339-4**
References	RB5	Srimanta Pal, Numerical methods	Oxford latest edition	**10-0-19-569375-2**
References	RB6	Gerald Wheatley, applied numerical analysis	Pearson education, 6th edition	**81-7808-567-4**
References	RB7	Dr.M.K.Venkataraman, Linear Algebra	National Publishing Company, I edition	---
References	RB8	Kenneth Hoffman and Ray Kunze Linear Algebra	Eastern Economy edition, II edition	**81-203-0270-2**

CMR Institute of Technology, Bangalore		
Department: Mechanical Engineering		
Semester: 01 (M Tech)		
Finite Element Method	16MDE12	Lectures/week: 06
Course Instructor: Prof. Prashant S. Hatti		
Course duration: Sep 2016 –Dec 2016		

Lesson Plan

Lecture #	Book & Sections	Topics	Portions coverage %	
			Individual	Cumulative
1 - 9	RB 3 : 1.1 - 1.5, RB 2 : 2.1, 2.5	**Introduction to Finite Element Method:** Basic Steps in Finite Element Method to solve mechanical engineering (Solid, Fluid and Heat Transfer) problems: Functional approach and Galerkin approach, Displacement Approach: Admissible Functions, Convergence Criteria: Conforming and Non Conforming elements, Co C1 and Cn Continuity Elements. Basic Equations, Element Characteristic Equations, Assembly Procedure, Boundary and Constraint Conditions.	15	15
10 - 28	TB 1: 3.8, 2.2 5.1 – 5.4 RB 3 : 9.1, 9.3	**Solid Mechanics : One-Dimensional Finite Element Formulations and Analysis** – Bars- uniform, varying and stepped cross section-Basic(Linear) and Higher Order Elements Formulations for Axial, Torsional and Temperature Loads with problems. Beams- Basic (Linear) Element Formulation-for uniform, varying and stepped cross section- for different loading and boundary conditions with problems. Trusses, Plane Frames and Space Frame Basic(Linear) Elements Formulations for different boundary condition - Axial, Bending, Torsional, and Temperature Loads with problems.	25	40
29 - 44	RB 1: 9.1, 9.2	**Two Dimensional Finite Element Formulations for Solid Mechanics Problems:** Triangular Membrane (TRIA 3, TRIA 6, TRIA 10) Element, Four-Noded Quadrilateral Membrane (QUAD 4, QUAD 8) Element Formulations for	25	65

		in-plane loading with sample problems. Triangular and Quadrilateral Axi-symmetric basic and higher order Elements formulation for axi-symmetric loading only with sample problems **Three Dimensional Finite Element Formulations for Solid Mechanics Problems:** Finite Element Formulation of Tetrahedral Element (TET 4, TET 10), Hexahedral Element (HEXA 8, HEXA 20), for different loading conditions. Serendipity and Lagrange family Elements		
45 - 57	RB 3 : 11.1 – 11.4	**Finite Element Formulations for Structural Mechanics Problems:** Basics of plates and shell theories: Classical thin plate Theory, Shear deformation Theory and Thick Plate theory. Finite Element Formulations for triangular and quadrilateral Plate elements. Finite element formulation of flat, curved, cylindrical and conical Shell elements	20	85
58 - 62	RB 3 : 12.1 – 12.5	**Dynamic Analysis:** Finite Element Formulation for point/lumped mass and distributed masses system, Finite Element Formulation of one dimensional dynamic analysis: bar, truss, frame and beam element. Finite Element Formulation of Two dimensional dynamic analysis: triangular membrane and axisymmetric element, quadrilatateral membrane and axisymmetric element. Evaluation of eigen values and eigen vectors applicable to bars, shaft, beams, plane and space frame.	15	100

Syllabus for Internal Assessment Tests (IAT)*

IAT #	Sylla
IAT-1	Class # 01 – 20
IAT-2	Class # 21 – 44
IAT-3	Class # 45 - 62

Literature:

Book Type	Code	Author & Title	Publication information	
			Edition // Publisher	ISBN
Text Book	TB1	T.R.Chandrupatla, A.D Belegunde	3rd Edition, PHI	0-13-061591-9
Text Book	TB2	H.V. Lakshminarayana "Finite Element Analysis"	Orient Blackswan Pvt Ltd, New Delhi	978-8-17-371476-4
Reference	RB1	Daryl L. Logan, "A first Course in Finite Element	Thomson Canada Limited.	0-534-55298-6
Reference	RB2	J.N.Reddy, "An Introduction to Finite Element Method"	McGraw -Hill International Edition.	978-0-07-060741-5
Reference	RB 3	S.S. Rao, "Finite Element Method in Engineering"	4th Edition, Elsevier	0-7056-7828-3

CMR Institute of Technology, Bangalore		
Department: Mechanical Engineering		
Semester: 01 (M.Tech)		
Continuum Mechanics	16CAE13	Lectures/week: 06
Course Instructor: Mr.H.Manikandan		

Lesson Plan

Class #	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
Analysis of Stress				
1-8	TB-1 Chap 1, 2, 3	Continuum concept, homogeneity, isotropy, mass density, body force, surface force Cauchy's stress principle-stress vector, State of stress at a point- stress tensor, stress tensor –stress vector relationship, Force and moment, equilibrium, stress tensor symmetry. Stress transformation laws, stress quadric of Cauchy. Principal stresses, Stress invariants, stress ellipsoid, maximum and minimum shear stress, Mohr's circle for stress, plane stress, deviator and spherical stress tensors	18%	18%
Deformation and Strain				
9-15	Chap 1, 2, 3	Particles and points, continuum configuration-deformation and flow concepts. Position vector, displacement vector-Lagrangian and Eulerian description, deformation gradient, displacement gradient.Deformation tensors, finite strain tensors, small deformation theory, infinitesimal strain tensors.Relative displacement- linear, rotation tensors.Transformation properties of strain tensors. Principal strains, strain invariants, cubical dilatation, spherical and deviator strain tensors, plane strain, Mohr's circle, and compatibility equations.	10%	28%
Linear Elasticity				
16-26	TB-1 Chapter 6	Generalized Hooke's law, Strain energy function, isotropy, anisotropy, elastic symmetry. Isotropic media-elastic constants. Elastostatic and Elastodynamic problems. Theorem of superposition, uniqueness of solutions, St. Venant's principle.	2%	30%
Two dimensional elasticity				
27-36	TB-1 Chapter 6	plane stress, plane strain, Airy's stress function. Two dimensional elastostatic problems in polar coordinates. Hyperelasticity, Hypoelasticity, linear thermo elasticity.	20%	50%

Plasticity				
37 - 41	RB-2 Chap-4	Basic concept and definitions, idealized plastic behavior. Yield condition- Tresca and Von-Mises criteria. Stress space-ı-plane, yield surface. Post yield behavior-isotropic and kinematic hardening. Plastic stress-strain equations, plastic potential theory. Equivalent stress, equivalent plastic strain increment. Plastic work, strain hardening hypothesis. Total deformation theory-elastoplastic problems. Elementary slip line theory for plane plastic strain	10%	60%
Viscoelasticity				
42 - 46	TB-1 Chapter 9	Linear viscoelastic behavior. Simple viscoelastic models-generalized models, linear differential operator equation. Creep and Relaxation- creep function, relaxation function, hereditary integrals. Complex moduli and compliances. Three dimensional theoryviscoelastic stress analysis, correspondence principles	20%	80%
Fluids				
47-52	RB-1 Chap-8	Fluid pressure, viscous stress tensor, barotropic flow. Constitutive equations-Stokesian, Newtonian fluids. Basic equation for Newtonian fluid, Nevier-Strokes-Duhum equations. Steady flow, hydrostatic, irrotational flow. Perfect fluids- Bernoulli's equation, circulation, potential flow, plane potential flow.	20%	100%
Fundamental Laws of Continuum Mechanics				
53-60	RB-1 Chap-8	Conservation of mass, continuity equation. Linear momentum principle, equation of motion, equilibrium equations. Moment of momentum principle. Conservation of energy first law of thermodynamics energy equation. Equation of state, entropy, second law of thermodynamics. Clausius-Duhem inequality, dissipation function. Constitutive equations-thermo mechanical and mechanical continua		

Syllabus for Sessionals:

Sessional #	Syllabus
T1	Class # 01 – 26
T2	Class # 27 - 41
T3	Class # 42 - 60

Literature:

Book Type	Code	Author & Title	Publication info	
			Edition & Publisher	ISBN #

Text Book	TB1	George. E. Mase, Continuum Mechanics	CRC Press, 2000	978-1-4200-8538-9
References	RB1	George E. Mase, Schaum's Outline of Continuum Mechanics	McGraw-Hill, 1970.	07-040663-4
References	RB2	Dill, Ellis Harold, Continuum Mechanics: Elasticity, Plasticity, Viscoelasticity	CRC Press , 2006.	10: 0-8493-9779-0

CMR Institute of Technology, Bangalore		
Department: Mechanical Engineering		
Semester: 01 (M.Tech)		
Computer Applications in Design	16MDE152	Lectures/week: 06
Course Instructor: Mr.H.Manikandan		

Lesson Plan

Class #	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
Introduction To CAD/CAM/CAE Systems				
1-10	TB-1 1.1-1.4, 2.1-2.4 RB-2 2.1-2.7	Overview, Definitions of CAD. CAM and CAE, Integrating the Design and Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for Product Development-A Practical Example. Components of CAD/CAM/CAE Systems: Hardware Components ,Vector-Refresh(Stroke-Refresh) Graphics Devices, Raster Graphics Devices, Hardware Configuration, Software Components, Windows-Based CAD Systems.	18%	18%
Basic Concepts of Graphics Programming				
11-16	TB-1 3.1 – 3.11 RB-2 5.1-5.8, 6.3, 13.1 – 13.10 14.1,14.2, 14.5	Graphics Libraries, Coordinate Systems, Window and Viewport, Output Primitives - Line, Polygon, Marker Text, Graphics Input, Display List, Transformation Matrix, Translation, Rotation, Mapping, Other Transformation Matrices, Hidden-Line and Hidden-Surface Removal, Back-Face Removal Algorithm, Depth-Sorting, or Painters, Algorithm, Hidden-Line Removal Algorithm, z-Buffer Method, Rendering, Shading, Ray Tracing, Graphical User Interface, X Window System.	10%	28%
Standards				
17-22	TB-1 14.1 – 14.4	Standards for Communicating Between Systems: Exchange Methods of Product Definition Data, Initial Graphics Exchange Specification, Drawing Interchange Format, Standard for the Exchange of Product Data. Tutorials, Computational exercises involving Geometric Modeling of components and their assemblies	2%	30%

Geometric Modeling Systems				
23-28	TB-1 5.5-5.6	Wireframe Modeling Systems, Surface Modeling Systems, Solid Modeling Systems, Modeling Functions, Data Structure, Euler Operators, Boolean Operations, Calculation of Volumetric Properties, Non manifold Modeling Systems, Assembly Modeling Capabilities, Basic Functions of Assembly Modeling, Browsing an Assembly, Features of Concurrent Design, Use of Assembly models, Simplification of Assemblies, Web-Based Modeling	20%	50%
Representation and Manipulation of Curves				
28 - 34	TB-1 6.1-6.4	Types of Curve Equations, Conic Sections, Circle or Circular Arc, Ellipse or Elliptic Arc, Hyperbola, Parabola, Hermite Curves, Bezier Curve, Differentiation of a Bezier Curve Equation, Evaluation of a Bezier Curve	10%	60%
Representation and Manipulation of Surfaces:				
35 - 45	TB-1 7.1-7.9	Types of Surface Equations, Bilinear Surface, Coon's Patch, Bicubic Patch, Bezier Surface, Evaluation of a Bezier Surface, Differentiation of a Bezier Surface, B-Spline Surface, Evaluation of a-B-Spline Surface, Differentiation of a B-Spline Surface, NURBS Surface, Interpolation Surface, Intersection of Surfaces.	20%	80%
CAD and CAM Integration				
46-56	TB-1 10.1-10.5	Overview of the Discrete Part Production Cycle, Process Planning, Manual Approach, Variant Approach, Generative Approach, Computer-Aided Process Planning Systems, CAM-I CAPP, MIPLAN and Multi CAPP, Met CAPP,ICEM-PART, Group Technology, Classification and Coding, Existing Coding Systems, Product Data Management (PDM) Systems.	20%	100%

Syllabus for Sessionals:

Sessional #	Syllabus
T1	Class # 01 – 22
T2	Class # 23 - 34
T3	Class # 35 - 56

Literature:

Book Type	Code	Author & Title	Publication info	
			Edition & Publisher	ISBN #
Text Book	TB1	Kunwoo Lee, "Principles of CAD/CAM/CAE systems"-	Addison Wesley, 1999	0-201-38036-6
References	RB1	Ibrahim Zeid, Mastering CAD/CAM	McGraw Hill, 1998	0-070-63434-3
References	RB2	Donald Hearn & Pauline Baker Computer Graphics C Version	2nd Edition, Pearson India	8-177-58765-X

CMR Institute of Technology, Bangalore		
Department: Mechanical Engineering		
Semester: 01 (M Tech)		
Experimental Mechanics	16CAE16	Lectures/week: 06
Course Instructor: Prof. Prashant S. Hatti		
Course duration: Sep 2016 –Dec 2016		

Lesson Plan

Lecture #	Book & Sections	Topics	Portions coverage %	
			Individual	Cumulative
1 - 9	TB1: 2.1 – 2.12, 3.1-3.3, 3.6- 3.16,3.19	**Introduction**: Definition of terms, calibration, standards, dimension and units, generalized measurement system, Basic concepts in dynamic measurements, system response, distortion, impedance matching, experiment planning. **Analysis of Experimental Data:** Cause and types of experimental errors, error analysis. Statistical analysis of experimental data- Probability distribution, gaussian, normal distribution. Chi-square test, Method of least square, correlation coefficient, multivariable regression, standard deviation of mean, graphical analysis and curve fitting, general consideration in data analysis.	20	20
10 - 28	TB1: 14 -14.7 10-10.10	**Data Acquisition and Processing:** General data acquisition system, signal conditioning revisited, data transmission, Analog-to-Digital and Digital-to- Analog conversion, Basic components (storage and display) of data acquisition system. Computer program as a substitute for wired logic. **Force, Torque and Strain Measurement:** Mass balance measurement, Elastic Element for force measurement, torque measurement. Strain Gages -Strain sensitivity of gage metals, Gage construction, Gage sensitivity and gage factor, Performance characteristics, Environmental effects Strain, gage circuits, Potentiometer, Wheat Stone's bridges, Constant current circuits. Strain Analysis Methods-Two element and three element, rectangular and delta rosettes, Correction for transverse strains effects, stress gage - plane shear gage, Stress intensity factor gage.	20	40

29 - 44	RB1: 11-11.3, 11.5, 14.2-14.6	**Stress Analysis:** Two Dimensional Photo elasticity - Nature of light, - wave theory of light,- optical interference - Polariscopes stress optic law - effect of stressed model in plane and circular Polariscopes, Isoclinics Iso-chromatics fringe order determination - Fringe multiplication techniques - Calibration Photoelastic model materials. Separation methods shear difference method, Analytical separation methods, Model to prototype scaling**.**	25	65
45 - 57	RB 1 : 15 – 15.9	**Three Dimensional Photo elasticity:** Stress freezing method, General slice, Effective stresses, Stresses separation, Shear deference method, Oblique incidence method Secondary principals stresses, Scattered light photo elasticity, Principals, Polari scope and stress data analyses**.**	15	80
58 - 62	RB2:9.1-9.4,10.1, 10.7 - 10.8, 13.1-13.3, 17.4-17.7	**Coating Methods:** a) Photoelastic Coating Method-Birefringence coating techniques Sensitivity Reinforcing and thickness effects – data reduction - Stress separation techniques Photoelastic strain gauges. b) Brittle Coatings Method: Brittle coating technique Principles data analysis - coating materials, Coating techniques. c) Moire Technique - Geometrical approach, Displacement approach- sensitivity of Moire data data reduction, In plane and out plane Moire methods, Moire photography, Moire grid production. **Holography:** Introduction, Equation for plane waves and spherical waves, Intensity, Coherence, Spherical radiator as an object (record process), Hurter, Driffeld curves, Reconstruction process, Holograpic interferomerty, Realtime. and double exposure methods, Displacement measurement, Isopachics.	20	100

Syllabus for Internal Assessment Tests (IAT)*

IAT #	Sylla
IAT-1	Class # 01 – 20
IAT-2	Class # 21 – 44
IAT-3	Class # 45 - 62

Literature:

Book Type	Code	Author & Title	Publication information	
			Edition // Publisher	ISBN
Text Book	TB1	**Holman,** "Experimental Methods for Engineers" Tata McGraw-Hill Companies, Inc, New York, 2007.	Eighth Edition, Tata, McGraw-Hill Companies	978-0-07-352930-1
Reference	RB1	**Dally and Riley,** Experimental Stress Analysis	Tata McGraw Hill,	
Reference	RB2	**Sadhu Singh**, Experimental Stress Analysis	Fourth Edition, Khanna publisher.	81-7409-182-3