BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI - HYDERABAD CAMPUS
FIRST SEMESTER 2022 - 2023
(COURSE HANDOUT PART II)

Date: 07/08/2022

In addition to part-I (general handout for all courses in the time-table), this handout provides the specific details regarding the course.

Course No.: ME G535

Course Title: Advanced Engineering Mathematics

Instructor(s): K. Ram Chandra Murthy, Bagadi Ramana Murthy

Instructor-in-charge: K. Ram Chandra Murthy

Description : Boundary value problems; wave equations; nonlinear partial differential equations; calculus of variations; Eigen value problems; iteration problems including forward and inverse iteration schemes – Graham Schmidt deflation – simultaneous iteration method – subspace iteration – Lanczo's algorithm – estimation of core and time requirements

1. **Course Description:** Vectors, Matrices & Vector Calculus, Ordinary Differential Equations, Laplace Transform, Numerical Methods, Systems of Differential Equations, Partial Differential Equations, Probability & Statistics.

2. **Scope and Objective:** To equip the students of mechanical engineering with advanced mathematical tools and techniques. Students will be able to: Derive Mathematical models of physical systems, Solve differential equations using appropriate techniques, Apply MATLAB/ Appropriate computer tools to solve Engineering problems, Analyze variety of experimental and observational data by statistical methods

3. **Text Book(s):**
   T1   Advanced Engineering Mathematics, 4th Edition, Dennis G. Zill and Warren S. Wright, Jones & Bartlett Learning, 2011.

   Reference Book(s) & other resources:
   R1   Advanced Engineering Mathematics, 2nd Edition, Michael Greenberg, 2002
   R2   Advanced Engineering Mathematics, 9th Edition, Erwin Kreyszig, Willey-India Pvt. Ltd., 2011

4. **Course Plan**:

Lecture Nos.	Learning Objectives	Topics to be covered	Book
1-3	Vectors, Matrices	Vectors in 2d, 3d, dot product, cross product, lines and planes in 3-space, Matrix Algebra, Systems of linear algebraic equations, Rank	T1
4-7	Matrices, Vector Calculus	Determinants, Inverse of a matrix, Cramer's rule, Eigen value problem, vector function, motion on a curve, curvature and components of acceleration, Partial derivatives, directional derivatives, tangent planes, normal lines, curl and divergence	T1
8-9	Introduction to Differential Equations	Modelling using Ordinary Differential Equations	T1
10-12	First Order Differential Equations: Analytical Methods	Solution curves, separable equations, linear equations, exact equations, solution by substitutions, linear and nonlinear models, modelling with system of first order differential equations.	T1
13-16	Higher Order Differential Equations: Analytical Methods	Initial and boundary value problems, reduction of order, homogeneous linear equations with constant coefficients, undetermined coefficients, variation of parameters, Cauchy-Euler equations, Non-linear equations, linear models-IVPs, BVPs, Nonlinear models, systems of linear equations	T1
17-19	Integral Transforms for the solution of ODEs	Definition of Laplace Transforms and Laplace Transforms of some standard functions, Translation Theorems	T1
20-22	Integral Transforms	Additional Operational properties, systems of linear differential equations	T1

Lecture Nos.	Learning Objectives	Topics to be covered	Book
23-25	Numerical methods	Euler method, Runge-Kutta methods: Solution using MATLAB / Excel	T1
26-28	Systems of Differential Equations	System of linear differential Equations, theory of linear systems, homogeneous systems, solution by diagonalization, Non homogeneous linear systems	T1
29-32	Orthogonal Functions and Fourier Series	Orthogonal Functions, Fourier Series, Fourier Cosine and sine series. Sturm-Liouville Problem	T1
33-38	Boundary Value problems & Integral Transform Method	Separable PDEs, classical PDEs, BVPs, Heat Equation, Wave equation, Laplace Equation, Non Homogeneous BVP, Orthogonal Series Expansion, Error function, Applications of the Laplace transform	T1
39-40	Miscellaneous Topics	To be announced	T1

5. **Evaluation Scheme**:

Evaluation Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-semester exam	90 min	20	05/11 11.00 -12.30PM	CB
Lab	---	25	Continuous	OB
Project + Seminar	---	15	To be announced in the class	OB
Comprehensive Exam	180 min	40	29/12 FN	CB

6. **Chamber Consultation Hour**: To be announced in the class room.

7. **Notices**: All notices concerning this course shall be posted at **CMS**, the institute's web based course management system.

8. **Make-up Policy**: Make-up for tests needs prior permission and strictly meant only for serious hospitalization cases with proper documents.

9. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
ME G535