BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI - HYDERABAD CAMPUS

FIRST SEMESTER 2021 - 2022

(COURSE HANDOUT PART II)

Date: 07/08/2021

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

Instructor-in-charge: K. Ram chandra murthy

1. **Course 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.

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
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	T1

Lecture Nos.	Learning Objectives	Topics to be covered	Book
		linear systems	
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	25	To be announced	OB
Lab	---	15	Continuous	OB
Project + Seminar	---	20	To be announced in the class	OB
Comprehensive Exam	120 min	40	To be announced	OB

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