Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2019 - 2020
Course Handout Part II

Date:

In addition to Part - I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : *MATH F241*
Course Title : *Mathematical Methods*
Instructorincharge : *Santanu Koley*
Instructors : *Jagan Mohan Jonnalagadda*

Scope and Objective of the Course:

This course introduces different mathematical methods and their applications to many real life problems of science, engineering and technology.

Text Books:

T1: F. B. Hildebrand, Methods of Applied Mathematics, Dover Publications, Second Edition, 1992.
T2: Sudhakar Nair**,** Advanced Topics in Applied Mathematics: For Engineering and the Physical Sciences, Cambridge University Press, 2011.

Reference Books:

R1: G. B. Arfken and H. J. Weber, Mathematical Methods for Physicist, Academic Press 2002.
R2. Anadi S. Gupta, Calculus of Variations with Applications, Prentice - Hall of India Pvt. Limited, 2004.
R3. Lokenath Debnath and D. Bhatta, Integral Transform and their Applications, Taylor & Francis, 2002.
R4. Ivar Stakgold, Michael J. Holst, Green's Functions and Boundary Value Problems, Wiley, 3rd Edition, 2011.
R5. R P. Kanwal, Linear Integral Equations, Birkhauser Boston, 1996.

Lecture Plan:

Lecture No.	Learning Objectives	Topics to be covered	Text Book/Sec.
1 - 2	To deal with the formulation and theory of linear integral equations	**Integral Equations:** Introduction and relation between integral and differential equations.	**T1 (3.1 - 3.2)**
3 - 5	To introduce and interpret Green's function	Green's operator and Green's function, adjoint operator, Sturm - Liouville operator.	**T1 (3.3)**

6 - 12	To study different analytical procedures available for the exact solution of certain linear integral equations	Classification of integral equations, Fredholm equations, Hilbert - Schmidt theory, Iterative methods for solving equations of the second kind, the Neumann series and Fredholm theory.	**T1 (3.6 - 3.11)**
13 - 16	To describe various numerical methods for obtaining approximate solutions of certain linear integral equations	Approximation of Fredholm equations by set of algebraic equations, approximate methods by undetermined coefficients, method of collocation, method of weighing function, method of least squares.	**T1 (3.15 - 3.19)**
17 - 18	To introduce a powerful technique for solving linear and partial differential equations arising in engineering and physics when the domain is infinite or semi-infinite	Dirac - Delta function and its properties. Fourier series, Riemann - Lebesgue lemma, localization lemma, Fourier integral theorem, Fourier cosine and sine transforms.	**T2 Chapter I (Articles 1 - 10), T2 (3.1 - 3.4)**
19 – 21	To discuss important properties of Fourier transforms	Properties of Fourier transforms, properties of trigonometric transforms, transforms of elementary functions.	**T2 (3.5 - 3.7)**
22 - 26	To illustrate some examples of solutions of differential and integral equations obtained using the Fourier transform	Convolution integral, mixed trigonometric transform, Applications of Fourier transforms, discrete Fourier transform.	**T2 (3.8 - 3.9, 3.11, 3.18)**
27 - 31	To introduce the variational notation and derive the Euler equations relevant to a large class of problems	**Calculus of Variations:** Maxima and minima, The simplest case, illustrative examples**,** natural boundary conditions, transition conditions, the variational notation, general case of two independent variables.	**T1 (2.1 - 2.6)**

32 - 33	To determine one or more functions by a variational procedure in which variations are governed by one or more auxiliary conditions.	Constraints and Lagrange's multipliers.	**T1 (2.7)**
34-35	To solve variational problems in which the boundary of the region of integration is not completely specified but is to be determined together with the unknown function or functions.	Variable end points.	**T1 (2.8)**
36 - 38	To illustrate one of the important class of variational problems	Sturm - Liouville problems, Hamilton's principle, Lagrange's equations.	**T1 (2.9 – 2.11)**
39 - 41	To obtain approximate solutions of problems expressed in variational form	The Rayleigh - Ritz method.	**T1 (2.19)**

Evaluation Scheme:

S. No.	Evaluation Component	Duration	Weightage (%)	Date & Time	Nature of Component
1	*Quizzes (2)		14	Will be announced in the class	Closed book
2	Mid Sem Exam	1.5 Hour	30		Open book
3	Assignment (1)		14	Will be announced through CMS	Open book
4	Comprehensive Exam.	3 Hours	42		Closed book

***Best one out of two will be taken**

Make-up Policy: Make-up for Mid-Sem Exam will be given only for very genuine cases and prior permission has to be obtained from Instructor In-charge. No make-up for quizzes and assignments.

Chamber consultation hour: To be announced by the respective Instructor.

Notices: The notices concerning this course will be displayed in CMS only.

INSTRUCTOR-IN-CHARGE