

DEPARTMENT OF MATHEMATICS
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	MATHEMATICS-III		
Course Code	MAIR41	No. of Credits	4
Course Code of Pre-requisite subject(s)	MAIR11 and MAIR21		
Session	January 2023	Section (if, applicable)	-----
Name of Faculty	Dr. R. Ponalagusamy	Department	MATHEMATICS
Email	rpalagu@nitt.edu		
Name of Course Coordinator(s) (if, applicable)	-----		
E-mail	-----	Telephone No.	7402448889
Course Type	Core course		
Syllabus (approved in BoS)			
<p>Fourier series - Dirichlet's conditions - Half range Fourier cosine and sine series - Parseval's relation - Fourier series in complex form – Harmonic analysis.</p> <p>Classification of second order linear partial differential equations (PDEq); Method of separation of variables; Laplace equation; Solutions of one-dimensional heat and wave equations -Fourier series solution.</p> <p>Solution of systems of linear equations using LU decomposition, Gauss elimination and Gauss-Seidel methods; Lagrange and Newton's interpolations, Solution of polynomial and transcendental equations by Newton-Raphson method.</p> <p>Numerical integration by trapezoidal rule, Simpson's rule and Gaussian quadrature rule. Numerical solutions of first order ordinary differential equations (ODEq) by Euler's method, Modified Euler's method and 4th order Runge-Kutta method.</p>			

Reference Books

1. K. E. Atkinson. *An introduction to numerical analysis*, 2ed. Wiley & Sons, Inc, 1989.
2. R. Haberman. *Applied partial differential equations: with Fourier series and boundary value problems*, 4ed. Pearson, 2013.
3. M. K. Jain, S. R. K. Iyengar, and R. K. Jain. *Numerical methods: For scientific and engineering computation*, 7ed. New Age International Publishers, 2019.
4. E. Kreyszig, *Advanced Engineering Mathematics*, 10 ed. Wiley, 2011.
5. K. Sankar Rao. *Introduction to partial differential equations*, 3ed. PHI Learning Pvt Ltd, 2010.
6. S. S. Sastry. *Introductory methods of numerical analysis*, 5ed. PHI Learning Pvt Ltd, 2012.
7. Grewal, B.S., *Higher Engineering Mathematics*, Khanna Publishers, 2017.

COURSE OBJECTIVES

To express periodic and non-periodic functions in terms of sinusoidal functions.

To provide the basic concepts of numerical methods in view of solving linear systems and nonlinear equations.

To introduce several methods for the interpolation of data from chemical engineering problems

To learn various numerical computational techniques and apply to engineering problems.

To train students with mathematical aspects so as to comprehend, analyze, design and create novel products and solution for the real life problems.

MAPPING OF COs with POs

Course Outcomes	Aligned Programme Outcomes (PO)
1. To be familiar with expressing periodic as well as non-periodic functions in terms of sinusoidal functions.	1,5
2. To be knowledgeable about partial differential equations (PDEs) and how they serve as mathematical models for physical processes such as heat transfer problems in one-dimensional and two-dimensional cases, and one-dimensional wave equation.	1,5
3. Understanding and applying the methodologies to solve the system of linear equations numerically for exact/approximate solutions. To be familiar with methods for the interpolation of engineering data (two dimensional) with equal/unequal interval and computing real roots of a given nonlinear equations with error analysis.	1,5

4. Evaluating the difficult definite integrals and finding solution/ approximate solutions for first order ODEs using various numerical techniques.	1,5
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COURSE PLAN – PART II

COURSE OVERVIEW

- To have general awareness and to express periodic functions in terms of sinusoidal functions.
- To understand the Mathematical applications to Engineering problems using PDE.
- To have general awareness and understanding of Various numerical techniques to compute solutions of linear systems, to find solutions of nonlinear equations and to perform numerical integration.
- To impart the basic concepts of interpolation of two-dimensional data.
- To understand and obtain various numerical solutions of ODEs with error analysis.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week- 1	Introduction to Fourier series, Dirichlet's conditions, derivation of Euler's formulas, definition of Fourier series, Convergence of Fourier series at specific points.	Chalk and Talk
2	Week- 2	Fourier series expansion of some functions. Half range Fourier cosine series and sine series, related Theorems, Parseval's identity and some problems.	Chalk and Talk
3	Week- 3	Complex form of Fourier series and some problems. Harmonic Analysis and some problems.	Chalk and Talk
4	Week- 4	Partial Differential Equations(PDE), Classifications of PDE, one-dimensional heat flow equation. Solution of one-dimensional heat flow equation by the method of separation of variables, some problems in one-dimensional heat flow equation.	Chalk and Talk
5	Week- 5	Analytic solution of Two dimensional heat flow equation in steady flow in Cartesian and polar coordinates by the method of separation of variables, some problems.	Chalk and Talk

6	Week- 6	Analytic solution of one dimensional wave equation by the method of separation of variables and some problems.	Chalk and Talk
7	Week- 7	Introduction to numerical Methods, explanation of Gaussian elimination method, LU decomposition method, Gauss Seidel method and problems.	Chalk and Talk
8	Week- 8	Introduction to interpolation and its applications, Derivation of Newton's forward and backward formulas, Lagrange's interpolation formula, some problems.	Chalk and Talk
9	Week- 9	Derivation of formula of Newton-Raphson method for $f(x) = 0$ and some problems. Solving $f(x,y) = 0$ and $g(x,y) = 0$ by Newton-Raphson method. Some problems.	Chalk and Talk
10	Week- 10	Introduction to numerical integration, derivation of Newton's cote formula, Trapezoidal rule, Simpson's 1/3 rule, some problems.	Chalk and Talk
11	Week- 11	Numerical integration by Gaussian quadrature rule. Introduction to numerical solution of ordinary differential equations (ODE's), Euler's method, Euler's modified method, some problems.	Chalk and Talk
12	Week- 12	Taylor's series method, Some problems. Runge-Kutta method of the fourth order for solving first order linear ODE's, Some problems.	Chalk and Talk
13	Week-13	Runge-Kutta method of the fourth order for solving first order simultaneous linear ordinary differential equations. Some problems.	Chalk and Talk

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment – I	6th week	One Hour	20
2	Assessment – II	13th week	One Hour	20

3	Assignments - I & II	4 th week & 10 th week	21 Days	10
CPA	Compensation Assessment: Retest	15 th week	One Hour	20
4	Final Assessment	Second week of May, 2023	Three Hours	50

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Feedback from students during class committee meeting.
2. Anonymous feedback through questionnaire (as followed previously by the Institute).

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

1. Faculty can also be contacted over phone: 7402448889. E-mail: rpalagu@nitt.edu
2. Assessment-I and Assessment-II will be conducted in regular class.
3. Portions for Assessment-I are Unit-I and 50% of Unit-II (First paragraph and half of Second paragraph of syllabus).
4. Portions for Assessment-II are remaining 50% of Unit-II and Unit-III (Remaining half of Second paragraph and Third paragraph of syllabus).
5. Students who have missed the first or second or both Assessment(s) can register with the faculty concerned for the Re-Test examination which shall be conducted after the completion of the Assessment-II. The Re-Test shall be conducted for 20 marks comprising the syllabus of both first and second Assessments. The Re-Test shall be conducted before the regular semester examinations.
6. At least 75% attendance in each course is mandatory. Students with less than 75% in any course by the end of 9th week will be identified and alerted by the class committee.
7. Students who have failed in the semester examination with 'F' grade and those have missed the End semester examination due to genuine/medical reason shall take Reassessment (supplementary examination). Students should register their names for supplementary examination. The Supplementary Examination will normally be held during a specific week of the subsequent semesters. The supplementary examination shall be scheduled by the Office of the Dean Academic. The Supplementary Examination will be conducted by the course teacher who offered the course or a faculty member nominated by the HoD. For taking Supplementary Examinations, the students have to register the failed course with prescribed examination fee. The weightage for the supplementary examination shall be 100%. Absolute grading system with a passing minimum of

35% shall be followed.

8. Students awarded 'V' grade must compulsorily redo the course.

9. The passing minimum should be maximum of 35 or $\frac{\bar{x}}{2}$ where \bar{x} is the mean of the class.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM


- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

The above policy against academic dishonesty shall be applicable for all the programmes.


ADDITIONAL INFORMATION

Faculty is available for discussion after the class hours at the Department on the first floor of Lyceum. Room No. 222.

FOR APPROVAL


Course Faculty 19/11/2023
(Dr. R. PONALAGUSAMY)

CC-Chairperson


Dr. K. Sankar

HOD

 23/11/23