DEPARTMENT OF MATHEMATICS
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the program and specialization	M.Tech. / Structural Engineering		
Course Title	Applied Mathematics		
Course Code	MA624	No. of Credits	4
Course Code of Pre-requisite subject(s)	NIL		
Session	July 2022	Section (if, applicable)	-
Name of Faculty	Kanaga. R	Department	Mathematics
Email	416118052@nitt.edu	Telephone No.	7395836463
Name of Course Coordinator(s) (if, applicable)	-		
E-mail	-	Telephone No.	-
Course Type	☑ Core course ☐ Elective course		

Syllabus (approved in BoS)

Vector spaces and subspaces, solution of linear systems, Linear independence, basis, and dimension, The four fundamental subspaces, Linear transformations, Orthogonal vectors and subspaces, Cosines, and projections onto lines, Projections, and least squares, The fast Fourier transform, Eigenvalues, and eigenvectors, Diagonalization of a matrix, Difference equations and powers of matrices, Similarity transformations.

Laplace transform: Definitions, properties - Transform of the error function, Bessel's function, Dirac Delta function, Unit Step functions – Convolution theorem – Inverse Laplace Transform: Complex inversion formula – Solutions to partial differential equations: Heat equation, Wave equation.

Fourier transform: Definitions, properties – Transform of elementary functions, Dirac Delta function – Convolution theorem – Parseval's identity – Solutions to partial differential equations: Heat equation, Wave equation, Laplace, and Poisson's equations.

Concept of variation and its properties – Euler's equation – Functional dependent on first and higher order derivatives – Functionals dependent on functions of several independent variables – Variational problems with moving boundaries –Problems with constraints – Direct methods – Ritz and Kantorovich methods.

Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel transformation– Transformation of boundaries in parametric form– Physical applications: Fluid flow and heat flow problems.

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. Sankara Rao K., Introduction to Partial Differential Equations, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
2. Gupta A.S., Calculus of Variations with Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
3. Spiegel M.R., Theory and Problems of Complex Variables and its Application (Schaum's Outline Series), McGraw Hill Book Co., Singapore,1981.
4. James. G, Advanced Modern Engineering Mathematics, Pearson Education, Third Edition, 2004.
5. Lev. D. Elsgolc, Calculus of Variations, Dover Publications, New York, 2012.

COURSE OBJECTIVES

1. To develop students with knowledge in Laplace and Fourier transform.
2. To familiarize the students in the field of differential equations to solve boundary value problems associated with engineering applications.
3. To expose the students to the calculus of variation, conformal mappings, and tensor analysis.
4. To familiarize students with the field of bilinear transformations.
5. To expose students to the concept of vector analysis.

Mapping of course outcomes (COs) with program outcomes (POs)

Course Outcomes	**Aligned Programme Outcomes (PO)**

At the end of the course, students will be able 1. To solve boundary value problems using Laplace and Fourier transform techniques. 2. To solve fluid flow and heat flow problems using conformal mapping. 3. To develop the mathematical methods of applied mathematics and mathematical physics with an emphasis on the calculus of variation and integral transforms. 4. To apply vector calculus in linear approximations, optimization, physics, and engineering. 5. To solve physical problems such as elasticity, fluid mechanics and general relativity.	1,5 and 7

COURSE PLAN – PART II

COURSE OVERVIEW

1. Introduce vector spaces and subspaces and study the diagonalization of a matrix to solve Difference equations.
2. Study Laplace transform to solve the Heat equation, Wave equation.
3. Discuss Fourier transform and the properties to solve the Heat equation, Wave equation, Laplace, and Poisson's equations.
4. Explain the concept of variation and its properties to solve Variational problems with moving boundaries and Problems with constraints.
5. Learn conformal mappings, bilinear transformations, and Schwarz Christoffel transformations to solve fluid flow and heat flow problems

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	1st ,2nd & 3rd week	Vector spaces and subspaces, solution of linear systems, Linear independence, basis, and dimension, The four fundamental subspaces, Linear transformations, Orthogonal vectors and subspaces, Cosines, and projections onto lines, Projections and least squares, The fast Fourier transform, Eigenvalues, and eigenvectors, Diagonalization of a matrix, Difference equations and powers of matrices, Similarity transformations.	Chalk and Talk
2.	4th , 5th & 6th week	Laplace transform: Definitions, properties - Transform of error function, Bessel's function, Dirac Delta function, Unit Step functions – Convolution theorem – Inverse Laplace Transform: Complex inversion formula – Solutions to partial differential equations : Heat equation, Wave equation.	Chalk and Talk

3.	7th Week .	**Assessment - 1**	
4.	7th, 8th & 9th week	Fourier transform: Definitions, properties – Transform of elementary functions, Dirac Delta function – Convolution theorem – Parseval's identity – Solutions to partial differential equations: Heat equation, Wave equation, Laplace and Poisson's equations.	Chalk and Talk
5.	10th ,11th &12th week	Concept of variation and its properties – Euler's equation – Functional dependent on first and higher order derivatives – Functionals dependent on functions of several independent variables – Variational problems with moving boundaries –Problems with constraints – Direct methods – Ritz and Kantorovich methods.	Chalk and Talk
6.	12th Week	**Assessment - 2**	
7.	13th ,14th & 15th Week	Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel transformation– Transformation of boundaries in parametric form– Physical applications: Fluid flow and heat flow problems.	Chalk and Talk
8.	15th week	**Compensation Assessment**	
9.	After 15th Week	**End-Semester Exam**	

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week / Date	Duration	% Weightage
1.	Assessment- 1 (written exam)	7th Week	1 hour	20%
2.	Assessment -2 (written exam)	12th Week	1 hour	20%
3.	Assessment-3 (Assignments)	Every 3 weeks	1 week	10%
CPA	Compensation Assessment	15th Week	1 hour	20%

4.	Final Assessment (Written Exam)	After 15th Week	3 hours	50%

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

1. Feedback from the students during class committee meetings and in the class after assessments 1 and 2.
2. Online feedback through a questionnaire before the final assessment.
3. Student knowledge about the topics covered in this course will be judged through marks obtained in the examination.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email / phone etc)

Students can meet the course faculty for clarifying doubts by fixing an appointment through E-mail (kanagavennila75@gmail.com) or mobile (7395836463)

COMPENSATION ASSESSMENT POLICY

a) Students who have missed either Assessment-1 or Assessment-2 or both can register for Compensation Assessment which shall be conducted soon after the completion of Assessment-2 and before the final assessment.

b) The Compensation Assessment shall be conducted for 20 marks comprising the syllabus of both Assessment -1 & Assessment - 2.

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.

FOR APPROVAL

R. Kanagaraj
Course Faculty

CC-Chairperson

HOD