NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF MATHEMATICS

COURSE PLAN – PART I				
Name of the programme and specialization	M. Tech (Geotechnical Engineering)			
Course Title	Applied Mathematics			
Course Code	MA 602	**No. of Credits**	4	
Course Code of Pre-requisite subject(s)	-			
Session	July 2023	**Section**		
Name of Faculty	Mr. Arunkumar M and Mr. Farel William Viret Kharchandy			
Official E-mail	416121003@nitt.edu (Arun M) 416320051@nitt.edu (Farel)	**Mobile No.**	9976726231 (Arun M) 9774837523 (Farel)	
Name of Course Coordinator(s)	Dr. Vamsinadh Thota			
Official E-mail	vamsinadh@nitt.edu	**Telephone number**	-	
Course Type	☑ **Core course**	☐ **Elective course**		

Syllabus (approved in BoS)

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.

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.

Polar co-ordinates - Expressions of gradient of scalar point function – divergence and curl of a vector point function in orthogonal curvilinear co-ordinates - Summation convention – Contravariant and covariant vectors – Contraction of tensors – Inner product – Quotient law – Metric tensor – Christoffel symbols – Covariant differentiation.

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 IndiaPvt. 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

Objective of the course are as follows:

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 calculus of variation, conformal mappings and tensor analysis.
4. To familiarize students in the field of bilinear transformations.
5. To expose students to the concept of vector analysis.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

Course Outcomes (CO)	Programme Outcomes (PO)
On completion of this course students will be able to 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 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.	a,b,c

COURSE PLAN – PART II

COURSE OVERVIEW

This course will introduce different transforms, concept of variations, bilinear transformation, vector properties which help to solve various kind of problems in engineering.

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COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week	Topics	Mode of Delivery
1.	1st-4th week	Laplace transform – Definition- 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
2.	4th-7th week	Fourier transform- Definitions, properties – Transform of elementary functions, Dirac Delta function-Convolution theorem – Parseval's identity – Solutions to partial differential equations.	Chalk and talk
3.	7th -10th 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
4.	10th-12th 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
5.	12th-14th week	Polar co-ordinates - Expressions of gradient of scalar point function – divergence and curl of a vector point function in orthogonal curvilinear co-ordinates - Summation convention – Contravariant and covariant vectors – Contraction of tensors – Inner product – Quotient law – Metric tensor – Christoffel symbols – Covariant differentiation.	Chalk and talk

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S. No	Mode of Assessment	Week / Date	Duration	% Weightage
1.	Assessment- 1 (Cycle Test-1)	7th Week	1 hour	15%
2.	Assessment -2 (Cycle Test-2)	12th Week	1 hour	15%
3.	Assessment -3 (Assignment/Quiz)	-	-	10%
4.	Assessment-4 (Assignment/Seminar)	-	-	10%
CPA	Compensation Assessment	16th Week	1 hour	15%
5.	Final Assessment (Written Exam)	18th week	3 hours	50%

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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 the assessments 1 and 2.
2. Online feedback through questionnaire before the final assessment.
3. Student knowledge about the topics covered in this course will be judged through marks obtained in examinations.

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 (416121003@nitt.edu, 416320051@nitt.edu) or mobile (9976726231, 9774837523).

COMPENSATION ASSESSMENT POLICY

1. Students who miss 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.
2. The Compensation Assessment shall be conducted for the weightage of 15% comprising the syllabus of both Assessment -1 & Assessment – 2.
3. Students will not be allowed to enroll for Compensation Assessment to improve their marks.
4. Students will be allowed to enroll in Compensation Assessment only if they miss the either CT due to a genuine reason which they are able to prove while applying for compensation test.

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.

FOR APPROVAL

M. Arunkumar

(Arunkumar M)

Course Faculty

(Farel William Viret Kharchandy)

Course Faculty

CC-Chairperson

HOD