NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ___CIVIL ENGINEERING_____

COURSE PLAN – PART I			
Name of the programme and specialization	**M.TECH STRUCTUAL ENGINEERING**		
Course Title	**APPLIED MATHEMATICS**		
Course Code	**MA602**	**No. of Credits**	**4**
Course Code of Pre-requisite subject(s)	**-**		
Session	**July 2021**	**Section (if, applicable)**	**-**
Name of Faculty	**V. RAVICHANDRAN**	**Department**	**MATHEMATICS**
Official Email	**ravic@nitt.edu**	**Telephone No.**	**0431-250 3674**
Name of Course Coordinator(s) (if, applicable)			
Official E-mail		**Telephone No.**	
Course Type (please tick appropriately)	☐ **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 –InverseLaplace 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.

Calculus of Variation: 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.

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

Tensors: 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 - Contra-variant and covariant vectors –Contraction of tensors –Innerproduct –Quotient law – Metric tensor – Christoffel symbols – Covariant differentiation.

Reference Books

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

COURSE OBJECTIVES

1. To develop students with knowledge in Laplace and Fouriertransform.
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 COs with POs

Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
1. To solve boundary value problems using Laplace and Fourier transform techniques	**PO5**
2. To solve fluid flow and heat flow problems using conformal mapping	**PO5**
3. To develop the mathematical methodsof applied mathematics and mathematical physics with an emphasis on calculus of variation and integral transforms	**PO5**
4. To apply vector calculus in linear approximations, optimization, physics and engineering	**PO5**
5. To solve physical problems such as elasticity, fluid mechanics and general relativity	**PO5**

COURSE PLAN – PART II

COURSE OVERVIEW

This course aims to develop Laplace transform and Fourier transform techniques to solve certain PDEs. It also provides an introductiont to tensors, caculus of variations and conformal mappings.

COURSE TEACHING AND LEARNING ACTIVITIES			(Add more rows)
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	Weeks 1-4 Four hours/week	*Laplace transform:* Definitions, properties -Transform of error function, Bessel's function, Dirac Delta function, Unit Step functions – Convolution theorem – InverseLaplace Transform: Complex inversion formula –Solutions to partial differential equations: Heat equation, Wave equation. Assessment I	Online
2	Weeks 5-7 Four hours/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. Assessment II	Online
3	Weeks 8-9 Four hours/week	*Complex Variables:* Introduction to conformal mappings and bilinear transformations –Schwarz Christoffel transformation –Transformation of boundaries in parametric form – Physical applications: Fluid flow and heat flow problems. Assessment III	Online
4	Weeks 10-11 Four hours/week	*Calculus of Variation:* 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. Assessment IV	Online

5	Weeks 12-13 Four hours/week	*Tensors:* 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 - Contra-variant and covariant vectors – Contraction of tensors –Innerproduct –Quotient law – Metric tensor – Christoffel symbols – Covariant differentiation.	Online
6	Week 14	Assessment V (End Semester)	Online

COURSE ASSESSMENT METHODS (shall range from 4 to 6**)**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I/CT1	4	60min	20
2	Assessment II/CT2	7	60min	20
3	Assessment III/CT3	9	60min	15
4	Assessment IV/CT4	11	60min	15
CPA	Compensation Assessment*	12	60min	20/15
5				
6	Final Assessment *	13	120 min	30

***mandatory; refer to guidelines on page 4**

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

1. Feedback is collected by the institute through MIS.
2. Students are free to discuss and give feedback as soon as possible.

COURSE POLICY (including compensation assessment to be specified**)**

Assessments I-IV will be based on written test and oral viva. Rescheduling of the test/ viva is possible provided the request is made in advance by sending an email to ravic@nittedu. Only one compensation test will allowed for a student. Final examination will be a written examination. **Students should be present on video during all online examinations**.

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, IF ANY

FOR APPROVAL

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____

Head
Department of Civil Engineering
National Institute of Technology
Tiruchirappalli - 620 015.

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.