Subject Code	Subject Name	Teaching Scheme(Hrs)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETS 401	Applied Mathematics IV	04	--	01	04	--	01	05

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. Of Test 1 and Test 2					
ETS 401	Applied Mathematics IV	20	20	20	80	25	--	--	125

Course pre-requisite:

FE C 101 : Applied Mathematics I
FE C 201 : Applied Mathematics II
SE S 301 : Applied Mathematics III

Course objectives:
This course will present the method of calculus of variations (CoV), basic concepts of vector spaces, matrix theory, concept of ROC and residue theory with applications.

- To provide students with a sound foundation in mathematics and prepare them for graduate studies in Electronics and Telecommunication Engineering
- To provide students with mathematics fundamental necessary to formulate, solve and analyze engineering problems.
- To provide opportunity for students to work as part of teams on multi disciplinary projects.

Expected outcomes:
- Students will able to apply method of calculus of variations to specific systems, demonstrate ability to manipulate matrices and compute eigenvalues and eigenvectors, Identify and classify zeros, singular points, residues and their applications.
- Students will demonstrate an ability to identify formulate and solve Telecommunication Engineering problem using applied mathematics.
- Students who can participate and succeed in competitive exams like GATE, GRE.

Module No.	Unit No.	Topics	Hrs.
1. 0		**Calculus of variation**	**10**
	1.1	Euler Langrange equation, solution of Euler's Langrange equation (only results for different cases for function) independent of a variable, independent of another variable, independent of differentiation of a variable and independent of both variables	
	1.2	Isoperimetric problems, several dependent variables	
	1.3	**Functions involving higher order derivatives:** Rayleigh-Ritz method	
2.0		**Linear algebra: vector spaces**	**12**
	2.1	**Vectors in n-dimensional vector space**: Properties, dot product, cross product, norm and distance properties in n-dimensional vector space.	
	2.2	Metric spaces, vector spaces over real field, properties of vector spaces over real field, subspaces.	
	2.3	Norms and normed vector spaces	
	2.4	Inner products and inner product spaces	
	2.5	The Cauchy-Schwarz inequality, orthogonal Subspaces, Gram-Schmidt process	
3.0		**Linear Algebra: Matrix Theory**	**15**
	3.1	Characteristic equation, Eigenvalues and Eigenvectors, properties of Eigenvalues and Eigenvectors	
	3.2	Cayley-Hamilton theorem, examples based on verification of Cayley-Hamilton theorem	
	3.3	Similarity of matrices, Diagonalisation of matrix	
	3.4	Functions of square matrix, derogatory and non-derogatory matrices	
	3.5	Quadratic forms over real field, reduction of quadratic form to a diagonal canonical form, rank, index, signature of quadratic form, Sylvester's law of inertia, value-class of a quadratic form of definite, semi-definite and indefinite	
	3.6	Singular Value Decomposition	
4.0		**Complex variables: Integration**	**15**
	4.1	**Complex Integration:** Line Integral, Cauchy's Integral theorem for simply connected regions, Cauchy's Integral formula	
	4.2	Taylor's and Laurent's series	
	4.3	Zeros, singularities, poles of f(z), residues, Cauchy's Residue theorem	
	4.4	Applications of Residue theorem to evaluate real Integrals of different types	
		Total	**52**

Text books:

1) A Text Book of Applied Mathematics Vol. I & II by P.N.Wartilar & J.N.Wartikar, Pune, Vidyarthi Griha Prakashan., Pune
2) Mathematical Methods in science and Engineering, A Datta (2012)
3) Higher Engg. Mathematics by Dr. B.S. Grewal, Khanna Publication

Reference Books:

1) Todd K.Moon and Wynn C. Stirling, Mathematical Methods and algorithms for Signal Processing, Pearson Education.
2) Kreyszig E., Advanced Engineering Mathematics, 9th edition, John Wiley, 2006.
3) Linear Algebra- Hoffman & Kunze (Indian editions) 2002
4) Linear Algebra- Anton & Torres (2012) 9th Indian Edition.
5) Complex Analysis – Schaum Series.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered for final Internal Assessment.

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus.
4: Remaining question (Q.2 to Q.6) will be selected from all the modules.

Term Work/Tutorial:

At least 08 assignments covering entire syllabus must be given during the **Class Wise Tutorial**. The assignments should be students' centric and an attempt should be made to make assignments more meaningful, interesting and innovative.

Term work assessment must be based on the overall performance of the student with every assignment graded from time to time. The grades will be converted to marks as per **Credit and Grading System** manual and should be added and averaged. Based on above scheme grading and term work assessment should be done.