Semester: II						
NUMBER THEORY, VECTOR CALCULUS AND COMPUTATIONAL METHODS **Category: Applied Science Course** **Stream: Computer Science (Common to AI, BT, CS, CY, CD & IS Programs)** **(Theory)**						
Course Code	**:**	**MAT221CT**		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	42L+14T		**SEE Duration**	**:**	3 Hours

Unit-I	**09 Hrs**
Number Theory Divisibility, greatest common divisor, prime numbers, properties of prime numbers, fundamental theorem of arithmetic, congruence, linear congruence, multiplicative inverses, Euler's theorem, Euler's totient function, RSA public key encryption. Implementation using MATLAB.	
Unit – II	**09 Hrs**
Vector Differentiation Vector valued functions–2D and 3D scalar and vector fields. Derivative of vector function, tangent, velocity and acceleration. Gradient of a scalar field–Normal vector to the surface, directional derivative, scalar potential. Divergence and curl of a vector field, Laplacian of scalar field, Solenoidal and irrotational fields, physical interpretations. Simulation using MATLAB.	
Unit –III	**08 Hrs**
Vector Integration Line, surface and volume integrals. Green's theorem, Stokes theorem and Gauss divergence theorem (statements only)-Problems, solenoidal fields and irrotational fields. Work done by a force. Simulation using MATLAB.	
Unit –IV	**08 Hrs**
Linear Ordinary Differential Equations of Higher Order Standard form of higher order linear differential equation with constant coefficients. Solution of homogeneous equations–Complementary functions. Non homogeneous equations-Concept of inverse differential operator, methods of finding particular integral based on input function (force function), method of variation of parameters. Equations with functional coefficients–Cauchy equation. Applications-Simple harmonic motion, LRC circuits. Implementation using MATLAB.	
Unit –V	**08 Hrs**
Numerical Methods Finite differences, concept of forward and backward differences, introduction to interpolation and extrapolation. Newton-Gregory (N-G) forward and backward interpolation formulae, Lagrange interpolation formula, application oriented problems. Numerical differentiation based on N-G forward and backward interpolation, applications – velocity and acceleration. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the fundamental concepts of number theory, vector calculus, differential equations and numerical methods.
CO2	Apply the acquired knowledge of number theory, vector calculus, differential equations and numerical methods to solve the problems of engineering applications.
CO3	Analyze the solution of the problems using appropriate techniques of number theory, vector calculus, differential equations and numerical methods to the real - world problem and optimize the solution.
CO4	Interpret the overall knowledge of number theory, vector calculus, differential equations and numerical methods gained to demonstrate the problems arising in many practical situations.

Reference Books	
1	Higher Engineering Mathematics, B. S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
2	Schaum's Outline of Advanced Calculus, Robert Wrede and Murray Spiegel, 3rd Edition, 2010, McGraw-Hill Education, ISBN -10: 0071623663, ISBN -13: 978-0071623667.
3	Elementary Number Theory, David M. Burton, McGraw Hill, 7th Edition, ISBN: 978-0-07-338314-9.
4	Discrete and Combinatorial Mathematics, Ralph P. Grimaldi, 5th Edition, 2006, Pearson Education, ISBN-13: 978-81-7758-424-0.
5	Advanced Modern Engineering Mathematics, Glyn James and Phil Dyke, 5th Edition, 2018, Pearson Education, ISBN-13 978-1292174341, ISBN-10 9780273719236.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**