NATIONAL INSTITUTE OF TECHNOLOGY: TIRUCHIRAPPALLI- 620 015

DEPARTMENT OF MATHEMATICS

COURSE OUTLINE			
Course Title	**Mathematics – II**		
Course Code	**MAIR 21**	No. of Credits : **4**	
Department	**Mathematics**	Section: **Civil(B)**	
Pre-requisites Course Code		**+2 Mathematics, MAIR 11-Mathematics-I**	
Course Teacher(s)/Tutor(s)		Email Id	Telephone No.
Dr. R . Tamil Selvi		**tamil@nitt.edu**	**7598176202**
Course Type		**Core course**	

COURSE OVERVIEW

To understand the fundamental concepts and solve problems on Vector spaces, inner product spaces, Linear differential Equations, Line, Surface, and volume integrals in vector form, Analytic functions, conformal mapping, and complex integrations.

COURSE OBJECTIVES

Objective of the course is to

1. Introduce the structure vector space and various operations on it.
2. Introduce different method to solve the 2^{nd} order differential equations and its applications in electric circuit problems.
3. Familiarize concepts like differentiations and integration for function of complex variable.
4. Introduce vector differential operator for vector function and important theorems on vector functions to solve engineering problems.

COURSE OUTCOMES (CO)

	Aligned Programme Outcomes(PO)
After the completion of the course, students are able to • Perform standard operation in finite dimensional vector	

spaces

- Compute the dot product of vectors, lengths of vectors, and angles between vectors.
- Perform gradient, div, curl operator on vector functions and give physical interpretations.
- Use Green's , Gauss divergence and Stoke's theorems to solve engineering problems.
- solve higher order ODEs and interpret it geometrically.
- Compute differentiation of functions of complex variable.
- Construct analytic function for given real or imaginary part of it.
- find images of the given region by standard functions of complex variable.
- compute bilinear map by knowing the images of three points.

MAIR 21 MATHEMATICS-II

Vector space – Subspaces – Linear dependence and independence – Spanning of a subspace – Basis and Dimension. Inner product – Inner product spaces – Orthogonal and orthonormal basis – Gram- Schmidt orthogonalization process.

Basic review of first order differential equation - Higher order linear differential equations with constant coefficients –Particular integrals for $x^n, e^{ax}, e^{ax}\cos(bx), e^{ax}\sin(bx)$ – Equation reducible to linear equations with constant coefficients using $x = e^t$ - Simultaneous linear equations with constant coefficients – Method of variation of parameters – Applications – Electric circuit problems.

Gradient, Divergence and Curl – Directional Derivative – Tangent Plane and normal to surfaces – Angle between surfaces –Solenoidal and irrotational fields – Line, surface and volume integrals – Green's Theorem, Stokes' Theorem and Gauss Divergence Theorem (all without proof) – Verification and applications of these theorems.

Analytic functions – Cauchy – Riemann equations (Cartesian and polar) –Properties of analytic functions – Construction of analytic functions given real or imaginary part – Conformal mapping of standard elementary functions ($Z^2, e^z, \sin z, \cos z, z + \frac{k^2}{z}$) and bilinear transformation.

Cauchy's integral theorem, Cauchy's integral formula and for derivatives– Taylor's and Laurent's expansions (without proof) – Singularities – Residues – Cauchy's residue theorem – Contour integration involving unit circle.

COURSE TEACHING AND LEARNING ACTIVITIES			
S. No.	**Week**	**Topic**	**Mode of Delivery**
1.	**Week 1**	1. Vector space and examples of VS. 2. Subspace and examples 3. Linear independence, linear dependence. 4. More Problems +Tutorial	Chalk and Talk
2.	**Week 2**	5. Span, Basis, Dimension. 6. More Examples 7. Inner Product spaces & Orthogonality 8. Ortho normal basis + Tutorial.	
3.	**Week 3**	9. Gram Schmidt orthogonalization process 10. First order differential equation and its soln. 11. Higher order homogeneous Linear differential Equations and their solutions. 12. Particular integrals for Type-I, II, III + Tutorial	
4.	**Week4**	13. Particular Integrals for Type IV, V 14. Particular Integrals for Type VI 15. Equation reducible to linear equations with constant coefficients. 16. More Problems + Tutorial.	Chalk and Talk
5.	**Week 5**	17. Simultaneous Differential Equations 18. Method of Variation of Parameters 19. Applications – Electric Circuit Problems 20. Tutorial	
6.	**Week 6**	**Assessment-I** 21. Problems on Grad, Div, Curl, 22. Directional Derivative	

7. 8. 9. 10. 11.	Week 7 Week 8 Week 9 Week 10 Week 11	23. Tangent plane, normal to surfaces. 24. Angle between surfaces, Solenoidal, irrotational fields. 25. Line Integral & Problems 26. Green's Theorem +Tutorial 27. Surface &Volume Integral, Stokes' Theorem 28. Stokes' Theorem 29. Gauss Divergence Theorem 30. Problems+ Tutorial 31. Analytic function, C-R equation. 32. Problems on C-R equation 33. Cartesian and polar form of C-R –Eqn. 34. Properties and Construction of analytic function + Tutorial 35. Construction of analytic function (IP Given) 36. Conformal mapping 37. Conformal mapping of standard elementary mappings 38. Bilinear Transformations 39. Problems +Tutorial	Chalk and Talk
12. 13. 14.	Week 12 Week 13 Week 14	**Assessment-II** 40. Cauchy's integral Theorem 41. Cauchy's integral formula +Tutorial 42. Taylor's Series 43. Laurent's series 44. Singularities, Residues. 45. Cauchy's residue Theorem +Tutorial **Assignment** **Assessment-III(only for those who miss the Assessment I or II)** 46. Contour Integration. 47. Integration involving unit circle + Tutorial **Assessment-IV**	Chalk and Talk

COURSE ASSESSMENT METHODS

S.No.		Week/Date	Duration	% Weightage

1.	Assessment –I	6th week	1 Hour	20%	
2.	Assessment-II	12th week	1 Hour	20%	
3.	Assessment-III	13th week	1 Hour	20%	
4.	Assignment	13th week		10%	
5.	Assessment –IV		3 Hours	50%	Total : 100 Marks
6.	Reassessment for Absentees & Poor scorers (Assessments are fixed as above. No extra Assessment will be conducted)				

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

Reference Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 10th edn, John Wiley Sons, 2010.
2. Grewal, B.S., Higher Engineering Mathematics, 43rd edition, Khanna Publications, Delhi.
3. Gilbert Strang, Linear Algebra and its applications, 4th edn, Cengage Learning, 2006
4. James Ward Brown and Ruel V. Churchill, Complex variables and Applications, 9th edn, McGraw-Hill, 2013.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

1. **Students can meet the faculty at any stage in the course duration in case he/she finds difficulty in understanding the concept.**
2. **Feedback form will be issued to students to express their comments about the course before cycle test 1 & after completing the syllabus. Students are requested to give genuine feedback about the course.**
3. **Student knowledge about the topic covered in this course will be judged through marks obtained in examination.**

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1. **Examination**:
   - **a)** Students who have missed the first or second cycle test or both can register for Re-Test examination which shall be conducted soon after the completion of the second cycle test and before the regular semester examination.
   - **b)** The Re-Test examination shall be conducted for 20 marks comprising the syllabus of both first and second cycle tests.
   - **c)** Students should submit assignments before last date of submission. In case students fails to submit their assignments, he/she will get zero mark for that particular assignment.

2. **Attendance**:
   - a) The minimum attendance for appearing for the semester examination is 75%.
   - b) Those students, whose attendance falls below 75% but above 50% in a subject, shall attend mandatory classes before the semester examinations to qualify to write semester exam.
   - **c)** The students who are having attendance less than or equal to 50% has to redo the course.

3. The Institute follows relative grading with flexibility given to teachers to decide the mark ranges for grades. All assessment of a course will be done on the basis of marks.

4. The passing minimum should be $\frac{\bar{X}}{2}$ or $X_{max}/3$, whichever is less Where $\bar{X}$ is the mean of the class and X_{max} is the maximum mark in the class.

5. The Performance Analysis Committee, which shall meet within couple of weeks after the completion of all examinations, shall analyze the relative cumulative performance of students in all examinations (continuous and end-semester) of a course and finalize the letter grade ranges for the course.

6. The letter grades and the corresponding grade points are as follows:

Letter	S	A	B	C	D	E,R	F,I	V	FF	X
Grade(GP)	10	9	8	7	6	5	0	-	2	-

   - a) Students scoring less than the passing minimum marks in the assessments defined in the course plan shall be deemed to have not successfully completed the course and be given an 'F' grade.
   - b) Students awarded F grade may REDO the course or opt for formative assessment.
   - c) 'V' indicates lack of required attendance. Students awarded 'V' grade must

compulsorily redo the course.

d) 'I' grade indicates incompletion of formative assessment.

e) A student who gets an 'I' grade must necessarily convert it to a 'R' grade by completing the formative assessment.

f) An 'FF' grade is awarded for not completing the formative assessment in the prescribed maximum period of study due to gross negligence. An 'FF' grade will have a grade point of 2 and it will remain on the grade card permanently. This will be used in the CGPA calculations.

g) A student who earns a minimum of 5 grade points (a 'E' grade or a 'R' grade) in a course is declared to have successfully completed the course.

h) If the students fails to appear semester examination due to genuine/medical reason, can register for special end semester examination after approval from course teacher & Head of department of Mathematics/ Dean(Academic). The special end semester examination will be conducted within ten days from reopening of institute for next semester. Students should register their names with course teacher to appear for special end semester examination within three days from reopening of institute for next semester. Grade issued as per the guidelines followed for his/her batch students.

i) **There will be one reassessment (for 90 marks) for the students who have secured "F" in this course and will be conducted within ten days from reopening of institute for next semester.** Students should register their names with course teacher to appear for reassessment within three days from reopening of institute for next semester. If the students satisfy the criteria fixed by the faculty to promote E grade will be given E grade and others given 'F' grade.

FOR SENATE'S CONSIDERATION

Course Faculty R. Tamil Selvi **CC-Chairperson** 18/1/17 **HOD**

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