NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

Department of Mathematics

Course Title	Mathematics-II		
Course Code	MAIR21	No. of Credits	3(L)+1(T)=4
Department	Mathematics	Offered to	Chemical Engg.
Pre-requisites Course Code	MAIR11- Mathematics – I		
Faculty Name	Dr. P. Saikrishnan	Telephone No.	0431-2503687 & 9787877471
E-mail ID	psai@nitt.edu		
Course Type	Core Course		

COURSE OVERVIEW

➢ This course will introudce basic structures of linear algebra (i.e., vector space and inner product space).

➢ This course will familiarize theory and application of functions of complex variable and vector valued functions.

➢ This course will introduce theorey and application of higher order differential equations.

COURSE OBJECTIVES

➢ This course will familiarize concept of vector space and inner product operator over vector space.

➢ This course will explain the methods to solve higher order ordinary differential equations and its applications in electric circuit problems.

➢ This course will introduce functions of complex variable and different concepts on functions of complex variable, like differentabilty, conformal of complex function. Also introduce integration of complex function and highlight the integral theorems for closed contour integeration and its applications.

➢ Also this course will introduce the concept of differentiablity and intergal of vector valued function and important theorem on vector valued function.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
➢ Able to check linear dependent and independence of elements in vector space and able to find distance and angel between them. ➢ Able to solve some higher order ordinary differential equations and interpret the solution of it. ➢ Able to understand different operator on vector valued function. Able to use different relation of multiple integral of vector valued functions to solve engineering applications. ➢ Able to analyze complex function and its properties. Also able to explain the geometrical property of complex function. ➢ Able to integrate complex function and apply integral theorems to evaluate closed contour integral.	

MAIR21 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.	1st, 2nd & 3rd week	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.	Chalk and talk.
2.	4th & 5th week	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.	
3.	6th week	**Cycle test -1** **(portion: topic covered in first 4 weeks)**	
4.	6th , 7th & 8th week	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.	
5.	9th & 10th week	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.	
6.	11th week	**Cycle test – II** **(portion: topic covered in 5th - 8th week)**	
7.	11th & 12th week	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.	
8.	13th or 14th week	**Semester examination** **(portion: all the topics)**	

COURSE ASSESSMENT METHODS

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Cycle Test- I	6th week	60 minutes	20%
2.	Cycle Test-II	11th week	60 minutes	20%
3.	Semester Exam	13th or 14th week	3 hours	50%
4.	Assignments		Will be announced at the time of distribution of assignment sheets	10%

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

Reference Books:
1. Kreyszig.E , Advanced Engineering Mathematics, 10th edition, 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 and Applications, 9th edn, McGraw-Hill, 2013.

COURSE EXIT SURVEY

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 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.
   d) Students were strictly NOT allowed to reappear for any assessment to improve their marks.

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.

ADDITIONAL COURSE INFORMATION

Students can reach course faculty by fixing appointment through E-mail (psai@nitt.edu) or phone [9787877471 or intercom: 3687, during office hours (8.30am-5.15pm)].

FOR SENATE'S CONSIDERATION

Dr. P. Saikrishnan
(Course Faculty)   CC-Chairperson ⁸⁸¹¹ᵇ

Dr. K. Murugesan, Professor   10||20 17
Head, Dept of Mathematics