NATIONAL INSTITUTE OF TECHNOLOGY: TIRUCHIRAPPALLI - 620 015

DEPARTMENT OF MATHEMATICS

COURSE OUTLINE			
Course Title	FOURIER TRANSFORMS AND NUMERICAL TECHNIQUES		
Course Code	MAIR32	No. of Credits	**4**
Department	Mathematics	**Section- A**	B. Tech- EEE (2022-2026) (Semester- III)
Pre-requisites Course Code	MAIR12, MAIR22		
Faculty	Dr. T,N.Janakiraman and Dipjyoti Mondal		
Course Teacher-E-mail	janaki@nitt.edu	Mobile No.	9894794198
Course Type	General Institute Requirements		

COURSE OVERVIEW

This course will introduce the

1. Fourier series of given function and interpret its coefficients.
2. Fourier and inverse Fourier transform of functions.
3. Numerical solutions of the given system AX=B by direct and iterative methods.
4. Numerical solution of f(x)=0 and also nonlinear equations with two variables,
5. Interpolation of a polynomial function.
6. The best curve fitting for the given data.

And COURSE OBJECTIVES

Objective of the course is to introduce the concepts to

1. apply Fourier series and Fourier transform to solve the mathematical equations arising in electrical engineering.
2. understand the importance of transform techniques to solve engineering problems.
3. understand Fourier series analysis and its use in solving boundary value problems.
4. apply numerical methods for solving linear systems AX=B.
5. solve the equations of f(x)=0 as well as system of equations with two variables.
6. fit a best curve for the given data.

Mapping of COs and POs

COs / POs		**Course outcomes (COs)**					**COs**
		1	2	3	4	5	Upon completion of the course, the students will be able to
Programme Outcomes (POs)	1	H	H	H	H	H	1. Understand the Methodology to filter the exact/possible information using linear type(mathematical model) from a given function..
	2	H	H	H	H	H	2. Understand the Methodology to transform a given function into a new function using linear and bounded type filter(mathematical model) to estimate performance of a function in a selected domain.
	3	H	H	H	H	H	3. Analyze the methodology for the possible solution to system of linear type conditions using linear models.
	4	H	H	H	H	H	4. Design polynomial schemes to find parameters of function in the nullified condition.
	5	H	H	H	H	H	5. Finding a suitable/approximate representing function with one or two parameters, which includes expected occasions.
	6	H	H	M	H	H	
	7	M	L	M	M	H	
	8	L	L	L	L	L	
	9	H	H	H	H	H	
	10	M	M	M	M	M	
	11	M	H	M	H	H	
	12	H	H	H	H	H	

MAIR32 – FOURIER TRANSFORMS AND NUMERICAL TECHNIQUES

Fourier series - Dirichiet conditions – Euler Formula-Convergence and Half range Fourier cosine and sine series - Parseval's relation. Complex form of Fourier Series. Harmonic analysis.

Fourier transforms - Fourier integral theorem-Fourier cosine and sine transforms - inverse transforms - Convolution theorem and Parseval's identity for Fourier transforms- Finite cosine and sine transforms.

Solution of linear systems - Gaussian elimination and Gauss-Jordan methods - LU - decomposition methods - Crout's method - Jacobi and Gauss-Seidel iterative methods - sufficient conditions for convergence.

Solution of nonlinear equations - Bisection method - Secant method - Regula falsi method - Newton- Raphson method for f(x) = 0 and for f(x,y) = 0, g(x,y) = 0 - Order of convergence.

Newton's forward, backward and divided difference interpolation – Lagrange's interpolation – Curve fitting - Method of least squares and group averages - Least square approximation of functions - solution of linear difference equations with constant coefficients.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week	Topic	Mode of Delivery
1.	Weeks-1,2 &3	Fourier series - Dirichlet's conditions - Half range Fourier cosine and sine series - Parseval's relation - Fourier series in complex form – Harmonic analysis.	**Off-line Mode Chalk & Talk and Group Discussion**
2.	Weeks-4,5&6	Fourier transforms - Fourier cosine and sine transforms – inverse transforms - convolution theorem and Parseval's identity for Fourier transforms - Finite cosine and sine transforms.	
3.	Weeks-7,8&9	Solution of linear systems - Gaussian elimination and Gauss-Jordan methods - LU - decomposition methods - Crout's method - Jacobi and Gauss-Seidel iterative methods - sufficient conditions for convergence.	
4.	Weeks-10,11&12	Solution of nonlinear equations - Bisection method - Secant method - Regula falsi method - Newton-Raphson method for f(x) = 0 and for f(x,y) = 0, g(x,y) = 0 - Order of convergence.	
5.	Weeks-13&14	Newton's forward, backward and divided difference interpolation – Lagrange's interpolation –Curve fitting - Method of least squares and group averages - Least square approximation of functions - solution of linear difference equations with constant coefficients.	

COURSE ASSESSMENT METHODS				
S.No.	Plan	Week/Date	Duration	% Weightage
1.	Assessment – I	7th week	1.5 hours (Minimum)	20%
2.	Assessment - II	13th week	1.5 hours (Minimum)	20%
3.	Assessment - III (compensation)	14th week	1.5 hours (Minimum)	20%
4.	Assignment	--	--	10%
5.	End Semester Exam	15th or 16th week	3 Hours	50%

ESSENTIAL READINGS : Textbooks, reference books etc

Reference Books:

1. Grewal.B.S., Higher Engineering Mathematics, 43rdEdition, Khanna Publisher, Delhi, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2015.
3. David Kincaid and Ward Cheney, Numerical Analysis, 3rd edition, American Mathematics Society, (Indian edition) – 2010.
4. Gerald C.F., and Wheatley P.O., Applied Numerical Analysis, Addison-Wesley Publishing Company, 1994
5. Jain, M.K., Iyengar, S.R. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, New Age international, 2003.

COURSE EXIT SURVEY

1. Feedback from students during class committee meeting.
2. Anonymous feedback through questionnaire (as followed previously).

COURSE POLICY

1. Examination:

   a) Students who have missed the first or second assessment or both assessments can register for the Assessment - III examination which shall be conducted soon after the completion of the second assessment test and before the regular semester examination.

   b) The Assessment - III examination shall be conducted for 20 marks comprising the syllabus of both first and second assessment tests.

   c) Students should submit the assignments before the last date of submission. In case students fail to submit their assignments; he/she will get zero mark for that particular assignment.

2. Attendance:
   As per institute regulations applicable to the particular class.

3. Compensation assessment: Due to genuine reasons approved by CC-Chairperson, students who missed to write Assessment I/II or both may be allowed to write compensation assessment.

ADDITIONAL COURSE INFORMATION

Faculty is available for discussion after the class hours in the Department of Mathematics Room No. 217. Students can fix the appointments by sending an e-mail to janaki@nitt.edu and can come for discussion on all working days between 3 P.M. - 5:30 P.M.

FOR SENATE CONSIDERATION

Course Faculty: Dr.T,N.Janakiraman	CC-Chairperson	HOD
9/8/2023		11/08/23