NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI - 620 015

DEPARTMENT OF MATHEMATICS

COURSE OUTLINE

Course Title	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS		
Course Code	MAIR32	No. of Credits	**3**
Department	Mathematics	Section	B.Tech Metallurgical and Material Engineering (Semester- III)
Pre-requisites Course Code	MAIR11, MAIR21		
Faculty	Dr. T.N.Janakiraman		
Course Teacher/E-mail	janaki@nitt.edu	Mobile No.	9894794198
Course Type	General Institute Requirements(Core course)		

COURSE OVERVIEW

- This course will introduce the
    (1) formulas involved in the Laplace transforms and its applications in solving differential and integral equations.
    (2) Fourier series, Fourier transfroms and convolution theorem.
    (3) PDEs and its formations and its solutions, Also, to study the one dimetional heat and wave equations and its fourier solutions.

COURSE OBJECTIVES

Objective of the course is to introduce

1. Laplace Transforms and its applications to solve linear ODE problems.
2. To solve the integral equations.
3. Fourier series, Fourier transform functions and its properties.
4. Partial differential equations and methods to solve them.
5. One dimensional heat/wave equations and its solutions.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes(PO)
1. On completing this course student will be able to understand and apply the methodologies to solve the ordinary differential equations(ODEs), simultaneous equations with constant coefficients and integral equations using Laplace transforms.	

2. Fourier Series- Half range Fourier cosine and sine series, Parseval's relation. 3. Fourier transforms and its solutions can be obtained. 4. Understanding the basic concepts of forming partial differential equations by eliminating arbitrary constants and functions – solution of first order equations – four standard types – Lagrange's equation – homogeneous and non – homogeneous types of second order linear differential equation with constant coefficients. 5. Understanding the Applications of Partial Differential Equations – Solution of one - dimensional heat flow/wave equations – using the method of separation of variables.	The engineering under-graduates will apply their knowledge of Transforms, and Partial Differential Equations to solve the problems arising in the industry.

MAIR32 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

Laplace Transforms of standard functions – derivatives and integrals - Inverse Laplace Transform - Convolution theorem – Periodic functions - Application to ordinary differential equations and simultaneous equations with constant coefficients and integral equations.

Fourier series - Dirichiet conditions – Euler formula-Convergence and Half range Fourier cosine and sine series - Parseval's relation. Complex form of Fourier Seires. Hormonic analysis.

Fourier transforms-Fourier integral theorem-Fourier cosine and sine transforms-inverse transforms-Convolution theorem and Parsevals indentity for Fourier transforms- Finite cosine and sine transforms.

Formation of partial differential equations eliminating arbitrary constants and functions - Solution of first order equations - four standard types - Lagrange's equation - homogeneous and non-homogeneous type of second order linear differential equations with constant coefficients.

one-dimensional heat flow equation and one-dimensional wave equation – Variable separable solutions- Fourier series solution.

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	**Week**	**Topic**	**Mode of Delivery**
1.	Week- 1	Introduction to Laplace Transform(LT) and its applications, Definition, Existence of Laplace transform, Examples,	Chalk and Talk
2.	Week- 2	Properties of LT, LT of some functions, First translation theorem and inverse LT of some functions.	
3.	Week- 3	Derivatives and Integrals of LT, Convolution theorem-statement and proof, LT of periodic functions, LT of derivatives of f(t).	
4.	Week- 4	Solutions of ordinary differential equations, simultaneous differential equations and integral equations by using Laplace transform.	
5.	Week- 5	Fourier series – Importance and applications of Fourier series in engineering problems.	Chalk and Talk
6.	Week- 6	Fourier expansion for different functions. Dirichlet's conditions. Half range Fourier cosine and sine series- Series expansion for odd and even functions.	
7.	Week- 7	Parseval's relation. Problems using Parseval identity. Complex form of Fourier series. Harmonic analysis.	
8.	Week- 8	Fourier Transforms-Fourier integral theorem. Fourier cosine and sine transforms. Inverse transforms.	
9.	Week- 9	Convolution theorem. Convolution product of functions. Problem using convolution theorem.	Chalk and Talk
10.	Week- 10	Parsevals identity for Fourier transforms. Finite cosine and sine transforms	
11.	Week- 11	Formation of partial differential equations by eliminating arbitrary constants and functions.	
12.	Week- 12	Solution of first order equations – four standard types – Lagrange's equation.	
13.	Week- 13	Solution of homogeneous and non –homogeneous types of second order linear differential equation with constant coefficients	
14.	Week- 14, 15 and 16.	Applications of Partial Differential Equations.	Chalk and Talk

		Solution of one - dimensional heat flow equation and two dimensional heat flow equation - method of separation of variables using Fourier series.		

COURSE ASSESSMENT METHODS

S.No.	Plan	Week/Date	Duration	% Weightage
1.	Assessment – I	8th week	1 and 1/2 Hour	20%
2.	Assessment - II	13th week	1 and 1/2 Hour	20%
3.	Assessment - III	15th week	1 and 1/2 Hour	20%
4.	Two Assignments (each covering two units with five marks weightage)			10%
5.	End Semester Exam	17th or 18th week	3 Hours	50% Total : 100 Marks

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

Reference Books:

1. Sneddon, I. N., "Elements of Partial Differential Equations", Courier Corporation, 2013.
2. Grewal, B.S., Higher Engineering Mathematics, 43rd edition, Khanna Publications, Delhi.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2010.
4. K.Sankara Rao, Introduction to Partial Differential Equations, 3rd Edition, PHI Learning Private Ltd. 2012.
5. Debnath L., and Dambaru Bhatta, Integral Transforms and Their Applications, 2nd Ed. (Special Indian Ed).Chapman & Hall/CRC, Indian Edition, 2010.

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

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

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

1. Examination:
   a) Students who have missed the first or second Assessment test or both can register

for Assessment - III examination which shall be conducted soon after the completion of the second Assesment 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 Assesment 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:
   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 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.

5. 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.
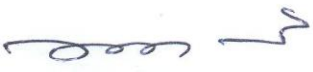
h) If the students fails to appear semester examination due to genuine/medical reason, can register for special end semester examination after approval from course teacher & Head of department of Mathematics/Dean(academic). The special end semester examination will be conducted within ten days from reopening 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.
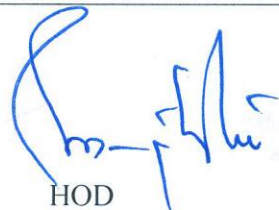
ADDITIONAL COURSE INFORMATION

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 in the afternoon 3:30 P.M. - 5:30 P.M.

FOR SENATE'S CONSIDERATION

Course Faculty :Dr.T.N.Janakiraman   CC-Chairperson   HOD
                                             Dr. B. RAVISANKAR