

DEPARTMENT OF MATHEMATICS

COURSE OUTLINE TEMPLATE			
Course Title	TRANSFORMS, SPECIAL FUNCTIONS AND PARTIAL DIFFERENTIAL EQUATIONS		
Course Code	MAIR31	No. of Credits	3
Department	Mathematics	Section	B.Tech Chemical (Semester- III)
Pre-requisites Course Code	MAIR11, MAIR21		
Faculty	Dr. N. Prakash	Course Coordinator(s) (if, applicable)	NIL
Other Course Teacher(s) / Tutor(s) E-mail	prakash.pdu@gmail.com	Telephone No.	7845688072
Course Type	Core course		
COURSE OVERVIEW			
<ul style="list-style-type: none"> • To have general awareness and understanding of <ol style="list-style-type: none"> (1) Various formulas involved in Laplace transforms of several functions in view of solving differential and integral equations. (2) Z-transforms of various functions, Fourier series and convolution theorem. (3) Bessel Functions and Legendre polynomials. • To understand and obtain various solutions of PDEs with applications. 			
COURSE OBJECTIVES			
<p>Learning Objectives: Objective of the course is to introduce</p> <ol style="list-style-type: none"> 1. Laplace Transforms and its applications to solve mathematical problems. 2. Z-transforms and its applications to solve difference equations. 3. Fourier series, Special functions and its properties. 4. Partial differential equations and method to solve them. 5. Mathematical model of one/two dimensional heat flow problems. 			
COURSE OUTCOMES (CO)			
Course Outcomes		Aligned Programme Outcomes (PO)	
1. Understanding and applying the methodologies to solve the ordinary differential equations (ODEs), simultaneous equations with constant coefficients and integral equations using Laplace transforms.			

2. Understanding the basic concepts of Z-Transforms-
Solution of difference equation using Z-Transforms -
Fourier Series- Half range Fourier cosine and sine series,
Parseval's relation.
3. Understanding the basic concepts of Bessel's
equation, Bessel functions- Legendre's equation-
Legendre polynomials.
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
equation and two dimensional heat flow equation -
method of separation of variables using Fourier series.

The engineering under-graduates will apply their knowledge of Transforms, special functions and Partial differential Equations techniques to solve industrially applicable problems.

MAIR31 - TRANSFORMS, SPECIAL FUNCTIONS 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.

Z-Transforms- inverse Z-transforms- Solution of difference equation with constant coefficients using Z-transforms- Fourier series - Dirichlet conditions – Half range Fourier cosine and sine series - Parseval's relation.

Bessel's Equation- Bessel Functions- Recurrence relations- Generating functions for Bessel functions- Legendre's equation- Legendre polynomials- Rodrigue's formula- Generating function and recurrence relations for Legendre polynomials- Orthogonality property of Legendre polynomials.

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.

Applications of Partial Differential Equations- Solutions of one-dimensional heat flow equation and two-dimensional heat flow equation (Cartesian and Polar form) in steady state by the method separation of variables using Fourier series.

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, Properties of LT, LT of some functions, First translation theorem and inverse LT of some functions.	Chalk and Talk
2.	Week- 2	Derivatives and Integrals of LT, Convolution theorem-statement and proof, LT of periodic functions, LT of derivatives of $f(t)$.	
3.	Week- 3	Solutions of ordinary differential equations, simultaneous differential equations and integral equations by using Laplace transform.	
4.	Week- 4	Introduction to Z-Transforms and inverse Z-transforms, Examples, Properties of ZT, ZT of some functions.	
5.	Week- 5	Solutions of difference equation with constant coefficients using Z-transforms. Fourier series – Importance and applications of Fourier series in technology.	
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. Introduction to Bessel's equation and Bessel functions. Recurrence relations.	
8.	Week- 8	Generating functions for Bessel functions. Legendre's equation. Legendre polynomials. Rodrigue's formula. Generating functions and recurrence relations for Legendre polynomials.	
9.	Week- 9	Orthogonality property of Legendre polynomials. Convolution theorem. Convolution product of functions. Problem using convolution theorem.	
10.	Week- 10	Formation of partial differential equations by eliminating arbitrary constants and functions.	

11.	Week- 11	Solution of first order equations – four standard types – Lagrange’s equation.	Chalk and Talk
12.	Week- 12	Solution of homogeneous and non – homogeneous types of second order linear differential equation with constant coefficients.	
13.	Week- 13	Applications of Partial Differential Equations.	
14.	Week- 14	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	7 th week	1 Hour	20%
2.	Assessment - II	12 th week	1 Hour	20%
3.	Assessment - III	14 th week	1 Hour	
4.	Assignments (each units two marks weightage)			10%
5.	End Semester Exam		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 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 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 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 incompleteness 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 at the Department on the first floor of Lyceum. Room No. 218.

FOR SENATE'S CONSIDERATION

Course Faculty

N. Prakesh

CC-Chairperson

S. Saravanan

HOD

Dr. K. MURUGESAN
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