Course Syllabus
Gyanmanjari Science College
Semester-2 (M.Sc.)

Subject: Special Functions and Transformations (MSCMA12507)

Type of course: Major

Prerequisite: A strong foundation in calculus, differential equations, complex numbers, linear algebra, and familiarity with basic transforms such as Fourier series and Laplace transform.

Rationale: The course integrates advanced mathematical functions, transforms, and their applications to cultivate analytical skills crucial for solving complex problems in diverse scientific and engineering domains.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	-	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V -- Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weightage
1	**CHAPTER 1:** Gamma and Beta functions, Relation between Gamma and Beta Functions. Elliptic Integral, Error Functions, Properties of Error Functions.	15	25
2	**CHAPTER 2:** Laplace Transform, Inverse Laplace Transform, Laplace Transforms of integrals, Laplace transforms of derivatives, Shifting property, property of division by 5, convolution theorem, Inverse Laplace Transforms of derivatives.	15	25
3	**CHAPTER 3:** Application of Laplace transforms to the solution of differential equations, the infinite Fourier Sine transform of F(x), The infinite Fourier Cosine transform of F(x). The infinite Fourier transform of F(x), Relation between Fourier transform and Laplace Transform. Examples of Fourier Transforms, Problems Related to Integral Equations.	15	25

4	**CHAPTER 4:** The Finite Fourier Sine Transform of F(x), The Finite Fourier Cosine Transform of F(x), Fourier Integral Theorem. Parseval's Identity for Fourier series, Parseval's Identity for Fourier transform Problems Related to Fourier Integral.	15	25

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1.	**Model making :** Engage students in creating physical models or visual representations to illustrate concepts from Gamma and Beta functions, Elliptic Integrals, Error Functions, Laplace Transforms, and Fourier Transforms. Photo/Video must be uploaded on to the GMIU web portal.	10
2.	**Chart :** Chart upon application of any topic of syllabus must be prepared by the students and upload to the GMIU web portal	10
3.	**Solving Mathematical Logic Problem:** Various problems based on Gamma and Beta functions, Elliptic Integrals, Error Functions, Laplace Transforms, and Fourier Transforms, etc. will be assigned to the students. Students need to submit Mathematical logic and Solution via the GMIU web portal.	10
4.	**Analysis :** Faculty will assign a project that requires students to analyze real-world scenarios and students will analyze and prepare a report in 100 words and upload it to the GMIU web portal.	10
5.	**Concept mapping :** Faculty will assign real time project / problem that Students map their Idea, Solution for real time project / problem and upload it to the GMIU web portal.	10
Total		**50**

Course Outcome:

After learning the course the students should be able to:	
CO1	Understand the Error Functions in mathematical problem-solving.
CO2	Apply Laplace transforms to find inverses, utilize shifting and convolution properties, and understand the division property in problem-solving.
CO3	Analyze the Laplace transforms to solve differential equations, comprehend Fourier transforms, understand the transform relationship, and solve problems involving integral equations.
CO4	Find Finite Fourier Sine and Cosine Transforms, comprehend the Fourier Integral Theorem

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	10%	40%	30%	10%	10%	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MCQ etc.
From the content 10% topics are suggested for flipped mode instruction.
Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

Reference Books:

1. Higher Engineering Mathematics by: Dr. B. S. Grewal, KHANNA PUBLISHERS
2. Higher Engineering Mathematics Vol-IV by Dr. K. R. Kachot Mahajan Publishing House.
3. Laplace and Fourier Transforms by Goyal & Gupata, Pragati Prakashan,
4. Advanced Engineering Mathematics by E. Kreyszig, Wiley Student Edition, Eighth E. 1999.