RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY (Autonomous)

RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

B.TECH. DEGREE PROGRAMME

SECOND SEMESTER

(2020 ADMISSIONS)

100908/MA200A	**VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS**

SYLLABUS

Rajagiri Valley, Kakkanad,
Kochi 682 039, Kerala, INDIA
www.rajagiritech.ac.in

COURSE CODE	COURSE NAME	L	T	P	CREDIT	YEAR OF INTRODUCTION
100908/MA200A	VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS	3	1	0	4	2020

1. **Preamble:** This course introduces the concepts and applications of differentiation and integration of vector valued functions, differential equations, Laplace and Fourier Transforms. The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include the Calculus of vector valued functions, ordinary differential equations and basic transforms such as Laplace and Fourier Transforms which are invaluable for any engineer's mathematical tool box. The topics treated in this course have applications in all branches of engineering.

2. **Prerequisite:** Calculus of single and multi-variable functions.

3. **Syllabus**

Module 1: (Calculus of vector functions)

Vector valued function of single variable, derivative of vector function and geometrical interpretation, motion along a curve-velocity, speed and acceleration. Concept of scalar and vector fields , Gradient and its properties, directional derivative , divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields , independence of path and potential function(results without proof).

Module 2 (Vector integral theorems)

Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Surface integrals over surfaces of the form $z = g(x, y)$, $y = g(x, z)$ or $x = g(y, z)$, Flux integrals over surfaces of the form $z = g(x, y)$, $y = g(x, z)$ or $x = g(y, z)$, divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done.

Module- 3 (Ordinary differential equations)

Homogenous linear differential equation of second order, superposition principle, general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order only).Existence and uniqueness (without proof). Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients (for the right hand side of the form $x^n, e^{ks}, \sin ax, \cos ax, e^{ks}.\sin ax, e^{ks}.\cos ax$ and their linear combinations), methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficient using method of undetermined coefficient.

Module- 4 (Laplace transforms)

Laplace Transform and its inverse ,Existence theorem (without proof) , linearity, Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Dirac delta function and its Laplace transform, Solution of ordinary differential equation involving unit step function and Dirac delta functions. Convolution theorem(without proof)and its application to finding inverse Laplace transform of products of functions.

Module-5 (Fourier Transforms)

Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties. The Fourier transform of derivatives. Convolution theorem (without proof)

4. Text Books

1. H. Anton, I. Biven,S.Davis, "Calculus", Wiley, 10th edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th edition, 2016.

5. Reference Books

1. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson,Reprint, 2002.
3. Peter O Neil, Advanced Engineering Mathematics, 7th Edition, Thomson, 2007.

4. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6th edition, 2003.
5. VeerarajanT."Engineering Mathematics for first year", Tata McGraw - Hill, 2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th edition , 2010.
7. Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 2015.
8. Ronald N. Bracewell, "The Fourier Transform and its Applications", McGraw – Hill International Editions, 2000.

6. Course Outcomes: After the completion of the course the student will be able to

CO1: compute the derivatives and line integrals of vector functions and learn their applications.
CO2: evaluate surface and volume integrals and learn their inter-relations and applications.
CO3: solve homogeneous and non-homogeneous linear differential equation with constant coefficients.
CO4: compute Laplace Transform and apply to solve ODE's arising in engineering
CO5: determine the Fourier transforms of functions and apply them to problems arising in engineering.

7. Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	1			1	2		2
CO2	3	3	3	3	2	1			1	2		2
CO3	3	3	3	3	2	1			1	2		2
CO4	3	3	3	3	2	1			1	2		2
CO5	3	3	3	2	2	1			1	2		2

8. Assessment Pattern:

Learning Objectives	Continuous Internal Evaluation (CIE)		End Semester Examination (ESE out of 100)
	Internal Examination 1 (25)	Internal Examination 2 (25)	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evalaute			

9. Mark Distribution

Total	CIE				ESE
	Attendance	Internal Examination	Assignment/Quiz/Course Project	Total	
150	10	25 (Average of two scores)	15	50	100

10. End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.