RAGHU ENGINEERING COLLEGE

Autonomous

(Approved by AICTE, New Delhi, Accredited by NBA (CIV, MECH, ECE, CSE), NAAC with 'A+' grade & Permanently Affiliated to JNTU-GV Vizianagaram)

Dakamarri (V), Bheemunipatnam (M), Visakhapatnam District – 531 162 (A.P)

Phone: +91-8922-248001, 248002 Fax: + 91-8922-248011

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Course Code: 23BS102 | **L T P C**

I Year-II Semester | **3 0 0 3**

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to All Branches of Engineering)

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them in to advanced level by handling various real-world applications.

UNIT-I: DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE 10 Lectures

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits (sections 11.9 – 11.12, 12.5, 12.6, 12.8 of the text book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. solve a first order differential equation using various techniques (L3)
2. use a first order differential equation to get the solution of a simple electric circuit (L3)
3. discuss the method of finding orthogonal trajectories of a function (L2)

UNIT-II: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (CONSTANT COEFFICIENTS) 10 Lectures

Definitions, homogenous and non-homogenous, complimentary function, general particular integral, Wronskean, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion (sections 13.1 – 13.7, 13.8(i), 13.11, 14.1, 14.2, 14.5(ii) of the text book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. determine the solution of a linear differential equation of higher order (L3)
2. explain the method of variation of parameters to find a particular solution of second order differential equations (L2)
3. solve a higher order differential equation by analyzing a physical situation(L3)

UNIT-III: PARTIAL DIFFERENTIAL EQUATIONS 10 Lectures

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients (sections 17.1, 17.2, 17.3, 17.5, 17.8 – 17.11 of the text book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. know the methods of solving linear and non-linear first order, first degree partial differential equations.

UNIT-IV: VECTOR DIFFERENTIATION **10 Lectures**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions - Divergence and Curl, vector identities (sections 8.4 – 8.9 of the text book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. illustrate the concepts of gradient, divergence and curl (L4)
2. determine the directional derivative of a scalar point function(L3)
3. apply del operator to a vector point functions (L3)

UNIT-V: VECTOR INTEGRATION **10 Lectures**

Line integral- circulation- work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems (sections 8.11 – 8.16, 8.18 of the text book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. determine the work done in moving a particle along a path (L3)
2. interpret surface and volume integrals (L2)
3. apply vector integral theorems to multiple integrals (L3)

Course Outcomes:

After successful completion of the course, the students will be able to:

CO	COURSE OUTCOMES	BT
1	Solve the differential equations related to various engineering fields.	L3
2	Model engineering problems as higher order differential equations and solve analytically.	L3
3	Identify solution methods for partial differential equations that model physical processes.	L3
4	Interpret the physical meaning of different operators such as gradient, curl and divergence.	L3
5	Estimate the work done against a field, circulation and flux using vector calculus.	L3

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Correlation of COs with POs & PSOs:

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

Textbooks:

1. B.S.Grewal,HigherEngineeringMathematics,44/e,Khannapublishers,2017.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley &Sons, 2018.
2. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
3. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
5. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
6. B.V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education, 2017.

Web References:

1. https://www.coursera.org/courses?query=vector%20calculus.
2. https://www.khanacademy.org/math/differential-equations/first-order-differential-equations.