APPLIED MATHEMATICS-II

Subject Code : **No. of Credits :** 3 (TH:2,T:1,P:1)

I. RATIONALE:

An Applied Mathematics course covering integration, differential equations, transform techniques, and statistics gives engineering students essential tools to model, analyze, and solve real-world engineering problems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME:

Apply the concepts of Mathematics to solve industry-based technological problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS):

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1 - Solve the broad-based engineering problems of integration using suitable methods.

CO2 - Use definite integration to solve given engineering related problems.

CO3 - Apply the concept of differential equation to find the solutions of given engineering problems.

CO4 - Employ transform techniques to solve program specific problems.

CO5 - Apply fundamental statistical concepts to analyze and solve engineering problems.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	Theory Learning Outcomes (TLOs) aligned to COs	Learning content mapped with Theory Learning Outcomes (TLOs) and COs.	Suggested Learning Pedagogies.	No of Lecture	CO
1	**TLO1.1:** Solve the given simple problem(s) based on rules of integration. **TLO1.2:** Evaluate the given simple integral(s) using substitution method. **TLO1.3:** Integrate given simple functions using the integration by parts.	**Unit- I: Indefinite Integration** 1.1 Simple Integration: Rules of integration and integration of standard functions. 1.2 Integration by substitution. 1.3 Integration by parts.	Improved Lecture Demonstrati on Chalk-Board Presentations Video Demonstra-tions	13	CO 1

	TLO1.4: Solve the given simple integral by partial fractions.	1.4 Integration by partial fractions (only linear non repeated factors at denominator of proper fraction).			
2	**TLO2.1:** Solve given examples based on Definite Integration. **TLO2.2:** Use properties of definite integration to solve given problems. **TLO2.3:** Evaluate area bounded by a curve and axes. **TLO2.4:** Apply Trapezoidal and Simpson's 1/3 Rule for finding numerical solution of definite integration.	**UNIT - II Definite Integration** 2.1 Definite Integration: Definition, rules of definite integration with simple examples. 2.2 Properties of definite integral (without proof) and simple examples. 2.3 Applications of Integration for: (a) Simple problem on evaluation of area bounded by a curve and axes (b) Numerical Integration by Trapezoidal and Simpson's 1/3 Rule.	Video Simulation Chalk-Board Improved Lecture Presentations	10	CO 2
3	**TLO3.1:** Find the order and degree of given differential equations. **TLO3.2:** Form simple differential equation for given elementary engineering problems. **TLO3.3:** Solve given differential equations using the methods of Variable separable and homogeneous equation. **TLO3.4:** Solve given Linear Differential Equation and Exact Differential Equation (Introduce the concept of partial differential equation).	**UNIT - III Differential Equation** 3.1 Concept of Differential Equation. Order, degree of Differential equations. 3.2 Formation of Differential equations. 3.3 Methods of solving Differential Equations: (a)Variable Separable (b)Homogeneous (c) Linear Differential Equation (d) Exact Differential Equation.	Video Demonstra-tions Presentations Chalk-Board Improved Lecture Flipped Classroom	7	CO 3

4	**TLO4.1:** Find Laplace Transform of simple Functions. **TLO4.2:** Find Inverse Laplace Transform of simple Functions.	**UNIT – IV Transform Techniques** 4.1 Laplace Transforms: Definition and properties of Laplace Transform, Laplace Transform of standard Functions, Elementary Theorems and find Laplace Transform of simple Functions. 4.2 Inverse Laplace Transforms: Definition and properties of Inverse Laplace Transform, Inverse Laplace Transform of standard Functions, Elementary Theorems and find Inverse Laplace Transform of simple Functions.	Video Chalk-Board Flipped Classroom Presentations	7	CO 4
5	**TLO5.1:** Calculate Mean, Median and Mode of the given grouped and ungrouped data. **TLO5.2:** Calculate mean and standard deviation of ungrouped and grouped data related to the given simple engineering problem(s). **TLO5.3:** Calculate the coefficient of rank correlation.	**UNIT - V Statistics** 5.1 Measures of Central Tendency: Mean, Median, Mode. 5.2 Measure of Dispersion: Mean deviation and standard deviation. 5.3 Correlation, Find Co-efficient of rank correlation.	Improved Lecture Spreadsheet Tutorial Assignment Demonstra-tion Flipped Classroom	11	CO 5

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES:

Practical / Tutorial /Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles/ Tutorial Titles	No. of Hrs.	Relevant Cos
LLO1: Solve simple problems of Integration by substitution and parts	Integration by substitution and parts.	2	CO1

LLO2: Solve integration using by partial fraction	Integration by partial fractions. Numerical Integration by	2	CO1
LLO3: Solve problems on properties of definite integral.	Trapezoidal and Simpson's 1/3 Rule.	2	CO2
LLO4: Solve given problems for finding the area under the curve and volume of revolution.	Area under the curve. (Take programme specific problems).	2	CO2
LLO5: Solve engineering application problems using differential equation.	Applications of differential equations. (Take programme specific problems)	2	CO3
LLO6: Solve problems on Laplace transform and properties of Laplace transform.	Laplace transform and properties of Laplace transform. (Take programme specific problems)	2	CO4
LLO7: Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	Inverse Laplace transform and properties of Inverse Laplace transform. (Take programme specific problems)	2	CO4
LLO8: Use concept of deviation to crack branch specific problem.	Solve problems on standard deviation.	2	CO5

VI. SUGGESTED ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING):

ASSIGNMENT :-

1. Collect 10 examples, based on real world uses of applications of derivative.
2. To solve numerical integration problem using open-source software.
3. Collect 10 examples, based on real world uses of applications of differential equations.
4. To evaluate a simple definite integral as the limit of a sum and verify it by actual integration.
5. To Find the mean, median and mode of a simple data set using both Excel and manual calculation:

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED:

Sr. No.	Equipment Name with Broad Specifications	Relevant LLO No.
1	Open-source software like SageMaths, MATHS3D, GeoGebra, Graph, DPLOT, and Graphing Calculator (Graph Eq 2.13), ORANGE can be used for Algebra, Calculus, Trigonometry, and Statistics respectively.	All

VIII. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (SPECIFICATION TABLE):

Sr. No.	Unit	Unit Title	Aligned COs	Learning Periods (L+T)	Weightage %
1	I	Indefinite Integration	CO1	13	27
2	II	Definite Integration	CO2	10	21
3	III	Differential Equation	CO3	07	15
4	IV	Transform Techniques	CO4	07	15
5	V	Statistics	CO5	11	22
Grand Total				**48**	**100**

IX. SUGGESTED COS - POS MATRIX FORM:

Course Outcomes (COs)	Programme Outcomes (POs)						
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Lifelong Learning
CO1	3	2	-	-	-	-	2
CO2	3	2	-	-	-	-	2
CO3	3	2	-	-	-	-	2
CO4	3	2	-	-	-	-	2
Legends: - High:03, Medium:02, Low:01							

X. SUGGESTED LEARNING MATERIALS / BOOKS:

Sr. No.	Author	Title	Publisher with ISBN Number
1	Grewal B. S.	Higher Engineering Mathematics	Khanna publication New Delhi, 2013 ISBN: 8174091955
2	Dutta. D	A text book of Engineering Mathematics	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2

4	Das H.K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008 ISBN: 9788121903455
5	Marvin L. Bittinger David J. Ellenbogen Scott A. Surgent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
6	R. D. Sharma	Applied Mathematics	Dhanpat Rai Publications, New Delhi 110016. ISBN 978-93-80250-06-9
7	Gareth James, Daniela Witten, Trevor Hastie Robert and Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer New York Heidelberg Dordrecht London ISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook)
8	Spiegel Murray R.	Schaum's Outline: Statistics	McGraw-Hill Education ISBN-13:9781260011463
9	Spiegel Murray R.	Schaum's Outline: Laplace Transforms	McGraw-Hill Education ISBN-13:9780070602311
10	Jesus Martin, Michael Carr	Calculus for Engineering Students	Academic Press Inc ISBN-13: 9780128172100
11	Ewart S. Andrews, H. Bryon	The Calculus for Engineers Ordinary Differential	Creative Media Partners LLC ISBN-1346837309
12	Earl A. Coddington	Equations	Dover Publications Inc. ISBN13:9780486659428

XIII. LEARNING WEBSITES & PORTALS:

Sr. No.	Link / Portal	Description
1	http://nptel.ac.in/courses/106102064/1	Online Learning Initiatives by IITs and IISc
2	https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHo Pig	Concept of Mathematics through video lectures and notes
3	https://www.wolframalpha.com/	Solving mathematical problems, performing calculations,visualizing mathematical concepts.
4	http://www.sosmath.com/	Free resources and tutorials
5	http://mathworld.wolfram.com/	Extensive Math encyclopedia with detailed explanations of mathematical concepts
6	https://www.mathsisfun.com/	Explanations and interactive lessons covering various math's topics, from basic arithmetic to advanced

7	http://tutorial.math.lamar.edu/	Comprehensive set of notes and tutorials covering a wide range of mathematics topics.
8	https://www.purplemath.com/	Purplemath is a great resource for students seeking help with algebra and other foundational mathematics to improve learning.
9	https://www.brilliant.org/	Interactive learning in Mathematics
10	https://www.edx.org/	Offers a variety of courses
11	https://www.coursera.org/	Coursera offers online courses in applied mathematics from universities and institutions around the globe.
12	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range of mathematical courses.
Note: Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students.		

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