Utkal Gourav Madhusudan Institute of Technology, Rayagada
Academic Lesson Plan for 2nd Semester – 2025 (Summer)

Name of the teaching faculty : Dr. Pradeep Kumar Tripathy
Lecturer (Mathematics)
Discipline : Common (Civil / Electrical / E&TC / Mechanical Engg.)
Dept. : Department of Mathematics & Science
Semester : 2nd
Subject : Theory 3: Mathematics - II
No of Periods per week : 4 Total Periods : 60,
End Semester Exam. : 70 Marks Class Test (I.A.) : 30 Marks,
Total Marks : 100 Marks

Week	Period	Unit/Chapter	Topics to be covered
1^{st}	1^{st}	Unit-1	**Unit-1: Determinants and Matrices** Concepts of Determinants and its definition, Some related definitions, Expansion of 2nd order determinants, Minor, Cofactor, Discuss related problems.
	2^{nd}	Unit-1	Expansion of 3rd / Higher order determinants, Some Properties, Discuss related problems.
	3^{rd}	Unit-1	Product of two determinants, Discuss related problems.
	4^{th}	Unit-1	Solve the problems of determinants.
2^{nd}	1^{st}	Unit-1	Solve the problems of determinants.
	2^{nd}	Unit-1	Explain Cramer's Rule with Examples, Discuss Consistency of equations, Discuss related problems.
	3^{rd}	Unit-1	Discuss problems on Cramer's rule.
	4^{th}	Unit-1	Concepts of Matrix, its definition with examples, Types of Matrices with examples.
3^{rd}	1^{st}	Unit-1	Algebra of Matrices i.e. Addition, Subtraction, Multiplication(Scalar with matrix and matrix with another matrix), Equality, Transpose, Discuss related problems.
	2^{nd}	Unit-1	Algebra of Matrices, Discuss related problems.
	3^{rd}	Unit-1	Adjoint and Inverse of a Matrix, Discuss related problems.
	4^{th}	Unit-1	Solution of system of linear equations by using matrix inverse method, Discuss related problems.
4^{th}	1^{st}	Unit-2	**Unit-II: Integral Calculus** Concept of Anti-derivative/Primitive and Indefinite Integral, Fundamental Indefinite Integral Formulae, Solve simple problems on standard formula basis.
	2^{nd}	Unit-2	Some Standard Results/ properties on Integration, Solve some problems using standard formula and standard result.
	3^{rd}	Unit-2	Integration by Substitution, Discuss methods of evaluating diffent types of Integrals, Integral of the type $\int f(ax+b)\,dx$, Discuss related problems.

	4^{th}	Unit-2	Evaluate Integrals of the type $\int \sin^m x\,dx$, $\int \cos^m x\,dx$, where $m \leq 4$, Discuss related problems.
5^{th}	1^{st}	Unit-2	Evaluate Integrals of the type $\int \sin mx \cos nx\,dx$, $\int \sin mx \sin nx\,dx$, $\int \cos mx \cos nx\,dx$, $\int \sin mx \cos nx\,dx$, Discuss related problems.
	2^{nd}	Unit-2	Evaluate Integrals of the type $\int \frac{f'(x)}{f(x)}\,dx$ and $\int \{f(x)\}^n f'(x)\,dx$, Discuss related problems.
	3^{rd}	Unit-2	Evaluate Integrals of the type $\int \sin^m x \cdot \cos^n x\,dx$, where $m, n \in \mathbb{Z}^+$, Discuss related problems.
	4^{th}	Unit-2	Some Special Integrals like $\int \frac{1}{x^2+a^2}\,dx$, $\int \frac{1}{x^2-a^2}\,dx$, $\int \frac{1}{a^2-x^2}\,dx$, $\int \frac{1}{\sqrt{x^2+a^2}}\,dx$, $\int \frac{1}{\sqrt{x^2-a^2}}\,dx$, $\int \frac{1}{\sqrt{a^2-x^2}}\,dx$. Discuss related problems.
6^{th}	1^{st}	Unit-2	Evaluate Integrals of the type $\int \frac{1}{ax^2+bx+c}\,dx$, $\int \frac{1}{\sqrt{ax^2+bx+c}}\,dx$ and reducible to these forms, Discuss related problems
	2^{nd}	Unit-2	Evaluate Integrals of the type $\int \frac{px+q}{ax^2+bx+c}\,dx$, $\int \frac{P(x)}{ax^2+bx+c}\,dx$, where $P(x)$ is a polynomial of degree ≥ 2, $\int \frac{px+q}{\sqrt{ax^2+bx+c}}\,dx$, Discuss related problems.
	3^{rd}	Unit-2	(a) Evaluate Integrals of the type $\int \frac{1}{a\sin^2 x + b\cos^2 x}\,dx$, $\int \frac{1}{a+b\sin^2 x}\,dx$, $\int \frac{1}{a+b\cos^2 x}\,dx$, $\int \frac{1}{(a\sin x + b\cos x)^2}\,dx$, $\int \frac{1}{a+b\sin^2 x + c\cos^2 x}\,dx$, (b) $\int \frac{1}{a\sin x + b\cos x}\,dx$, $\int \frac{1}{a+b\sin x}\,dx$, $\int \frac{1}{a+b\cos x}\,dx$, $\int \frac{1}{a+b\sin x + c\cos x}\,dx$, (c) $\int \frac{a\sin x + b\cos x}{c\sin x + d\cos x}\,dx$ (d) $\int \frac{a\sin x + b\cos x + c}{p\sin x + q\cos x + r}\,dx$ Discuss related problems.
	4^{th}	Unit-2	Integration by parts and Discuss related problems.
7^{th}	1^{st}	Unit-2	Discuss related problems on Integration by parts.

	2^{nd}	Unit-2	Evaluate Integrals of the type $\int e^x\{f(x)+f'(x)\}\,dx$, Discuss related problems.
	3^{rd}	Unit-2	Evaluate Integrals of the type $\int e^{ax}\sin bx\,dx$, $\int e^{ax}\cos bx\,dx$, Discuss related problems.
	4^{th}	Unit-2	Evaluate Integrals of the type $\int \sqrt{a^2+x^2}\,dx$, $\int \sqrt{a^2-x^2}\,dx$, $\int \sqrt{x^2-a^2}\,dx$ $\int \sqrt{ax^2+bx+c}\,dx$, $\int (px+q)\sqrt{ax^2+bx+c}\,dx$
8^{th}	1^{st}	Unit-2	Integration of rational algebraic functions by using partial fraction method and discuss related problems on linear factors only.
	2^{nd}	Unit-2	Definite integral, Fundamental theorem of integral calculus, Properties and Discuss related problems .
	3^{rd}	Unit-2	Some more properties of Definite integral and Discuss related problems using this properties.
	4^{th}	Unit-2	Use the formula $\int_0^{\pi/2}\sin^n x\,dx$, $\int_0^{\pi/2}\cos^n x\,dx$, $\int_0^{\pi/2}\sin^m x\cos^n x\,dx$, where $m,n\in\mathbb{Z}^+$.
9^{th}	1^{st}	Unit-2	Area bounded by a curves and axes, Discuss related problems
	2^{nd}	Unit-2	Volume of a solid formed by revolution of an area about axes, Discussion of related problems.
	3^{rd}	Unit-3	**Unit-III: Co-ordinate Geometry** Introduction to Co-ordinate geometry, Discuss Distance formula, Section formula (Internal, External, and Mid-point formula), Area of a Triangle and polygon, Co-linear condition, and discuss simple related problems.
	4^{th}	Unit-3	Definition of Straight line, General form / equation of a straight line, Slope / Gradient, Angle between two lines, Discuss related problems.
10^{th}	1^{st}	Unit-3	Condition of Parallel and Perpendicular Straight lines, Intercept of a line on the axes, Equation of a line parallel to the coordinate axes, Discuss related problems
	2^{nd}	Unit-3	Different forms of straight lines, Slope Intercept form, Point Slope form, Two Point form, Discuss related problems
	3^{rd}	Unit-3	Intercept form, Normal / perpendicular form, Distance form, Discuss related problems.
	4^{th}	Unit-3	Transformation of general equation in different standard forms, Point of intersection of two lines, Condition of concurrency of three lines, Discuss related problems.
11^{th}	1^{st}	Unit-3	Condition for two lines to be coincident, parallel, perpendicular or intersecting, Lines parallel and perpendicular to a given line, Discuss related problems .
	2^{nd}	Unit-3	Angle between two lines, Distance of a point from a line, Distance between two parallel lines, Discuss related problems.
	3^{rd}	Unit-3	Definition of a circle, Equation of circle, Standard equation of circle (Centre & Radius form), Some particular cases, Discussion of related problems.

	4^{th}	Unit-3	General Equation of a circle and discuss it's properties, Discussion of related problems.
12^{th}	1^{st}	Unit-3	Discuss related problems to find the equation of a circle when three points lies on it.
	2^{nd}	Unit-3	Definition of conic sections, Standard equations of Parabola and Discussion of related problems.
	3^{rd}	Unit-3	Standard equations of Ellipse and Discussion of related problems.
	4^{th}	Unit-3	Standard equations of Hyperbola and Discussion of related problems.
13^{th}	1^{st}	Unit-4	**Unit-IV: Vector Algebra** Introduction to Vector, Define Scalar & Vector with examples, Symbolic Notation, Geometric representation, Rectangular resolution of a vector, Addition and subtraction of vectors, Triangle, parallelogram and polygon law of vector addition, Scalar Multiplication with a vector, Discussion of related problems.
	2^{nd}	Unit-4	Discussion of related problems on vector addition, subtraction and multiplication of a scalar with a vector.
	3^{rd}	Unit-4	Scalar / dot product of two vectors, Properties, Geometrical meaning, Discussion of related problems.
	4^{th}	Unit-4	Discussion of related problems on scalar / dot product of two vectors.
14^{th}	1^{st}	Unit-4	Vector / cross product of two vectors, Properties, Geometrical meaning, Discussion of related problems.
	2^{nd}	Unit-4	Discussion of related problems on vector / cross product of two vectors.
	3^{rd}	Unit-5	**Unit-V: Differential Equation** Introduction and definition of Differential equation, Order, Degree, Types of Differential equation: Ordinary & Partial, Solution of Differential equation (General & Particular), Discuss with examples.
	4^{th}	Unit-5	Solution of first order and first degree differential equation by variable separation method.
15^{th}	1^{st}	Unit-5	MATLAB- Introduction
	2^{nd}	Unit-5	MATLAB- Introduction
	3^{rd}	Discussion	Previous year semester questions
	4^{th}	Discussion	How to prepare for Semester Examination.

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