

COURSE INFORMATION SHEET

Program : Diploma in Engineering	
Course Code : 2002	Course Title : Engineering Mathematics II
Semester : 2	Credits : 6
Course Category : F	
Periods/Week : 6	Periods/Semester : 90

Course Objectives:

Provide students an understanding of

- vectors , different types of vectors, operations on vectors and its applications.
- the concept of factorials, combinations, binomial expansions.
- about the evaluation of 2×2 , 3×3 determinants and enable them to apply determinants for finding the solution of a system of linear equations in two or three unknowns.
- matrices, different types of matrices, operations on matrices, inverse matrix and how to find the solution of a system of linear equations in three unknowns by finding the inverse of the coefficient matrix.
- the concept of integration, different methods of integration and the evaluation of indefinite and definite integrals.
- how to apply integration for finding areas and volumes and also about the concept of differential equations and methods for finding its solutions.

Course Pre-requisites:

Topic/Description	Course code	Course name	Semester
Basic Mathematics			Entry level
Differentiation & Trigonometry	1002	Engineering Mathematics I	First Semester

Course Outcomes:

On completion of the course student will be able to:

CO No.	Description	Blooms Taxonomy level
1	Explain vectors, different types of vectors, operations on vectors, solve related problems and apply the results in vector algebra to find work done by a force and moment of a force.	I, II ,III ,IV

2	Explain the concepts of factorial, combinations, binomial expansions and solve related problems.	I, II, III, IV
3	Evaluate 2×2 and 3×3 determinants and apply determinants for finding the solution of a system of linear equations in two or three unknowns (Cramer's Rule)	I, II, III, V
4	Explain the concept of matrices, different types of matrices, operations on matrices, inverse matrix, solve related problems and find the solution of a system of linear equations in three unknowns by finding the inverse of the coefficient matrix.	I, III, IV
5	Explain the concept of integration, different methods of integration and evaluate indefinite and definite integrals.	I, III, IV
6	Apply integration for finding areas and volumes. Explain the concept of differential equations and methods for finding solutions of different types of differential equations and solve differential equations.	I, III, VI

I - Remember II - Understand III- Apply IV - Analyze V- Evaluate VI-Creating

Syllabus:

Module	Topics	Hours
I	<p>VECTOR ALGEBRA</p> <p>Scalar and vector quantities, Definition of a vector, Representation of vectors, Name a directed line segment as a vector, Different types of vectors, Addition and subtraction of vectors in terms of the segment, Position vector of a point with reference to a point, Difference of two vectors with same initial point as position vector of a point, Orthogonal Cartesian axes, the unit vectors i, j and k, Product of two vectors-scalar (dot) product and vector (cross) product, Properties of dot product and cross product (no proof), Simple problems to find (i) work done by a force (application of scalar product) (ii) moment of a force (application of vector product).</p> <p>BINOMIAL THEOREM</p> <p>Concept of factorial, Meaning of nCr and value of nCr (No proof and no problems), Use of nCr in the expansion $(x + a)^n$, where n is a positive integer, State binomial theorem for a positive integer, Expansion of $(x + a)^n$ and $(x - a)^n$, where n is positive integer (statement only), General term of the expansion of $(x + a)^n$ and $(x - a)^n$, Properties of binomial expansion, Problems of the following types (a) expand using Binomial theorem, (b) to find a particular term in the expansion, (c) to find middle term(s), (d) to find the coefficient of x^n (e) to find constant terms in $(x + a)^n$ and $(x - a)^n$.</p>	24

II	<p>DETERMINANTS</p> <p>Definition of determinant by means of algebraic expression , Order of a determinant, Evaluation of determinants of 2nd & 3rd order -problems, Solution of a system of simultaneous linear equations in two unknowns, Solution of a system of simultaneous linear equations in three unknowns</p> <p>MATRICES</p> <p>Definition of matrices, Order of matrices, Different types of matrices, Algebra of matrices such as Equality of matrices, Addition of matrices, Subtraction of matrices, Scalar multiplication and Multiplication, Problems on algebra of matrices, Transpose of a matrix, Symmetric and skew-symmetric matrices, Determinant associated with a square matrix, Singular and non singular matrices, Minors and cofactors, Cofactor matrix, Adjoint of a matrix, Inverse of a matrix, Solution of a system of three linear equations in three unknowns using the inverse of the coefficient matrix.</p>	22
III	<p>INTEGRAL CALCULUS</p> <p>Indefinite Integrals</p> <p>Integration as reverse process of differentiation, List standard integrals, Rules of integration</p> <p>(i) $\int (k f(x) dx = k \int f(x) dx$</p> <p>(ii) $\int (f(x) \pm g(x)) dx = \int f(x) dx \pm \int g(x) dx$</p> <p>Simple problems using standard results and rules of integration, Simple problems using algebraic simplification and trigonometric results, Integration by substitution method, Solve simple problems on substitution method, Evaluation of integrals of the form,</p> <p>1) $\int x^{n-1} f(x^n) dx$ 2) $\int (f(x))^{f'(x)} dx$ 3) $\int (f(x))^{n f'(x)} dx$</p> <p>4) $\int \frac{f'(x)}{f(x)} dx$ 5) $\int f(ax+b) dx$</p> <p>Integration by parts : Solutions of problems of the type $x \sin x$, $x^2 \cos x$, $(ax + b) e^x$, $x \sin 2x$, $\log x$, $e^x \sin x$, $x \log x$ etc.</p> <p>Definite Integrals : Meaning of $\int_a^b f(x) dx$ and definition of definite integral(Correct notation), Properties of definite integrals, Problems of the same type as in indefinite integral using limits of integration.</p>	18

IV	<p>APPLICATIONS OF INTEGRATION</p> <p>Area and Volume</p> <p>Formulae for finding area bounded by a curve and volume of a solid of revolution (no proof), estimation of the area bounded by the curve $y = f(x)$, the x- axis and the ordinates at $x=a$ and $x=b$, Estimation of the area bounded by the curve $y = f(x)$, and the x- axis , Estimation of the area enclosed between two curves $y_1 = f_1(x)$, and $y_2=f_2(x)$, Simple problems to find the volume of solid of revolution.</p> <p>Differential Equations</p> <p>Definition of differential equation with examples, Order and Degree of D E with examples, Solution of DE by variable separable method, Problems on variable separable method, Solution of a linear DE of the type $\frac{dy}{dx} + Py = Q$, Simple problems, Solution of D E of the type $\frac{d^2y}{dx^2} = f(x)$, Simple problems.</p>	16
	Tutorials, Tests, Assignments	10
	Total Hours	90

Text / Reference:

T/R	Book Title/Author
T1	Engineering Mathematics-II for Polytechnic Colleges by different authors
R1	Applied Mathematics- Dr. D. S. Prakash - S Chand Publications
R2	Applied Mathematics -W.R. Neelakanta -Sapna Publications.
R3	Calculus: One-variable Calculus (Vol I)-2nd Edition- Tom M Apostol - Wiley
R4	Higher Engineering Mathematics - B. S. Grewal., Khana publishers, 38th Edition
R5	Engineering Mathematics -Bali & Iyenger

Web Source Reference:

Sl No	Website Link
1	https://www.nptelonlinecourse.nic.in
2	math">https://www.khanacademy.org>math
3	https://www.britanica.com
4	wiki>differ">https://en.m.wikipedia.org>wiki>differ

Course Outcome No.	Description	Topic from syllabus	Student Learning Outcomes No.	Description	Suggested Learning Activities	Duration (Hours)	Blooms Taxonomy Level
CO ₁	Explain vectors, different types of vectors, operations on vectors, solve related problems and apply the results in vector algebra to find work done by a force and moment of a force.	Scalars & Vectors	SLO1	Define scalars with examples	Explanation with use of chalk and board Interactive lecture	4 hrs	I
			SLO2	Define vectors with examples			I
			SLO3	Represent vectors as a directed line segment			II
			SLO4	Define magnitude of vectors and its notations			I
			SLO5	Define unit vectors			I
			SLO6	Define zero vectors			I
			SLO7	Define negative vectors.			I
			SLO8	Define co-initial vectors.			I
			SLO9	Define collinear vectors.			I
			SLO10	Define like and unlike vectors			I
			SLO11	Define position vector of a point			I
			SLO12	Represent vector in terms of position vectors			II
			SLO13	State triangle law of vector addition			I
			SLO14	State parallelogram law of vector addition			I
			SLO15	Define unit vectors i, j, k along X-axis, Y-axis, Z-axis respectively			I
			SLO16	Represent vectors in terms of its components			II
			SLO17	Define magnitude of a vector given in terms of its components			I
		Operations of vectors	SLO18	Represent addition of vectors in terms of segment	Explanation with use of chalk and board Interactive lecture Practice exercise	4 hrs	II
			SLO19	Represent subtraction of vectors in terms of segment			II
			SLO20	Find the distance between two points if position vectors are given			I
			SLO21	Find the distance between origin and a point if position vectors are given			I
			SLO22	Define scalar multiplication of vectors			I
			SLO23	List properties of scalar multiplication			IV
			SLO24	Solve problems related to operations on vector algebra			III
			SLO25	Define scalar product(dot product)			I

			SLO26	Define vector product(cross product)			I
			SLO27	Define Scalar product in terms of components			I
			SLO28	Find scalar product of two vectors			I
			SLO29	Define vector product in terms of components			I
			SLO30	Find vector product of two vectors			I
			SLO31	Find unit vector along a given vector			I
		Properties of scalar product and vector products	SLO32	Define projection of a vector on another vector	Explanation with use of chalk and board Interactive lecture Practice exercise Group discussion	4 hrs	I
			SLO33	Find projection of a vector on another vector			I
			SLO34	State the condition for two vectors to be perpendicular			I
			SLO35	Apply the condition that scalar product is zero for two perpendicular vectors			III
			SLO36	State the formula to find the angle between two vectors			I
			SLO37	Apply formula to find the angles between two vectors using scalar product			III
			SLO38	State the condition for two vectors to be parallel			I
			SLO39	Apply condition for two vectors to be parallel or collinear			III
			SLO40	Solve problems in connection with scalar product			III
			SLO41	Define unit vector in the direction of two vectors			I
			SLO42	Find unit vector in the direction of two vectors			I
			SLO43	State the condition for two vectors to be collinear in vector product			I
			SLO44	Apply the condition for three points to be collinear			III
			SLO45	State the formula for finding the area of a parallelogram			I
			SLO46	Find area of a parallelogram in terms of vector product			I
			SLO47	State the formula for finding the area of a triangle			I
			SLO48	Find area of a triangle in terms of vector product			I

		Applications of scalar product and vector product	SLO49	State the formula for finding work done by a force	Explanation with use of chalk and board Interactive lecture Practice exercise	2 hrs	I			
			SLO50	Apply scalar product for finding work done by a force			III			
			SLO51	State the formula for finding moment of a force			I			
			SLO52	Apply vector product to find the moment of a force			III			
CO ₂	Explain the concepts of factorial, combinations, binomial expansions and solve related problems	Combinations	SLO53	Define factorial of a positive integer find factorial of a positive integer	Explanation with use of chalk and board Interactive lecture Practice exercise	1.5 hrs	I			
			SLO54	Find factorial of a positive integer			I			
			SLO55	Explain concept of combinations			II			
			SLO56	Identify different notations for combinations			III			
			SLO57	State formula for nCr			I			
			SLO58	Find the value of nCr			I			
			SLO59	List properties of nCr			IV			
			Binomial Expansion	SLO60			Explain how to apply nCr in the expansion of $(x+a)^n$	Explanation with use of chalk and board Interactive lecture Practice exercise	8.5 hrs	II
				SLO61			State binomial theorem for $(x+a)^n$			I
		SLO62		State properties of $(x+a)^n$	I					
		SLO63		State binomial theorem for $(x-a)^n$	I					
		SLO64		Find the expansion of binomials of the form $(x+a)^n$	I					
		SLO65	Find the expansion of binomials of the form $(x-a)^n$	I						
		SLO66	Find a particular term in the expansion of $(x+a)^n$	I						
SLO67	Find a particular term in the expansion of $(x-a)^n$	I								
SLO68	Find the middle term(s) of a binomial expansion	I								
SLO69	Find the coefficient of x^n in a binomial expansion	I								
SLO70	Find the constant term or term independent of x in a binomial expansion	I								
CO ₃	Evaluate 2×2 and 3×3 determinants and apply determinants for finding the solution of a system of	Determinants	SLO71	Define determinants and its notations	Explanation with use of chalk and board Interactive lecture Practice exercise	4 hrs	I			
			SLO72	Define order of a determinant			I			
			SLO73	Evaluate 2×2 determinants			V			
			SLO74	Solve for x if the value of a 2×2 determinant is given			III			
			SLO75	Evaluate of 3×3 determinants			V			
			SLO76	Solve for x if the value of a 3×3 determinant is given			III			

	linear equations in two or three unknowns (Cramer's Rule)	Solution of linear equations	SLO77	Explain Cramer's Rule	Explanation with use of chalk and board Interactive lecture Practice exercise	4 hrs	II
			SLO78	Solve two linear equations in two unknowns using determinants (Cramer's Rule)			III
			SLO79	Solve three linear equations in three unknowns using determinants (Cramer's Rule)			III
CO ₄	Explain the concept of matrices, different types of matrices, operations on matrices, inverse matrix ,solve related problems and find the solution of a system of linear equations in three unknowns by finding the inverse of the coefficient matrix.	Matrices	SLO80	Define Matrix, elements of Matrix, notation and representation	Explanation with use of chalk and board Interactive lecture Practice exercise	2 hrs	I
			SLO81	Define order of a matrix using examples			I
			SLO82	Represent generally a n x n matrix			I
			SLO83	Define square matrices, principal diagonal,diagonal elements with examples			I
			SLO84	Define upper and lower triangular matrices with examples			I
			SLO85	Define diagonal matrix with examples			I
			SLO86	Define scalar matrix , with examples			I
			SLO87	Define unit matrix with examples and its notations			I
			SLO88	Define row matrices with examples			I
			SLO89	Define column matrices with examples			I
			SLO90	Define equal matrices with examples			I
		SLO91	Solve for the values of the variables if two matrices are equal	III			
		Operations on matrices	SLO92	Define addition of matrices	Explanation with use of chalk and board Interactive lecture Practice exercise	3.5 hrs	I
			SLO93	List properties of matrix addition			IV
			SLO94	Define subtraction of matrices			I
			SLO95	Solve problems related to addition and subtraction of matrices			III
			SLO96	Define scalar multiplication			I
SLO97	List properties of scalar multiplication		IV				
SLO98	Solve problems related to scalar multiplication		III				
SLO99	Define multiplication of matrices and its properties		I				

		Transpose of a matrix	SLO100	List properties of matrix multiplication	Explanation with use of chalk and board Interactive lecture Practice exercise	2 hrs	IV
			SLO101	Solve problems related to matrix multiplication			III
			SLO102	Define transpose of a matrix and notations used			I
			SLO103	List properties of transposes			IV
			SLO104	Define symmetric matrix with examples			I
			SLO105	Define skew- symmetric matrix with examples			I
			SLO106	Solve problems related to transpose of a matrix			III
			SLO107	Define determinant associate with a square matrix			I
		SLO108	Define singular and non -singular matrix with examples	I			
		Adjoint and inverse of a matrix	SLO109	Define minors of elements of a matrix	Explanation with use of chalk and board Interactive lecture Practice exercise Group discussion	5 hrs	I
			SLO110	Define cofactors and cofactor matrix			I
			SLO111	Find minors of a matrix			I
			SLO112	Find co-factors & co-factor matrix			I
			SLO113	Define adjoint of a matrix			I
			SLO114	Find adjoint of a matrix			I
			SLO115	Define inverse of a matrix and its formula			I
		SLO116	Apply formula to find the inverse of a matrix	III			
		Solution of linear equations	SLO117	Explain the method for solving a system of three linear equations in three variables using inverse of matrix	Explanation with use of chalk and board Group discussion Practice exercise	1.5 hrs	I
SLO118	Solve three linear equations in three variables using inverse of matrix		III				
CO ₅	Explain the concept of integration , different methods of integration and evaluate indefinite and definite integrals.	Indefinite Integral	SLO119	Explain integration as the reverse process of differentiation	Explanation with use of chalk and board Interactive lecture Practice exercise Group discussion	10 hrs	I
			SLO120	List standard integrals			IV
			SLO121	State Rules of Integration			I
			SLO122	Apply standard integrals and rules in problems			III
			SLO123	Apply trigonometric results to evaluate integrals			III
			SLO124	Find integrals using algebraic simplification			I
			SLO125	Find integrals by substitution method			I
			SLO126	Find integrals of the form $\int x^{n-1} f(x^n) dx$			I
			SLO127	Find integrals of the form $\int (f(x))f'(x) dx$			I

			SLO128	Find integrals of the form $\int (f(x))^{n-1} f'(x) dx$	Explanation with use of chalk and board Interactive lecture Practice exercise	8 hrs	I				
			SLO129	Find integrals of the form $\int \frac{f'(x)}{f(x)} dx$			I				
			SLO130	Find integrals of the form $\int f(ax+b) dx$			I				
			SLO131	State Integration by parts			I				
			SLO132	Apply Integration by parts to find integrals of product of two functions			III				
		Definite Integral	SLO133	Explain meaning of definite integral			Explanation with use of chalk and board Interactive lecture Practice exercise	8 hrs	I		
			SLO134	Define Definite integral					I		
			SLO135	List properties of definite integrals					IV		
			SLO136	Apply limits of integration to problems solved in indefinite integral					III		
		CO ₆	Apply integration for finding areas and volumes .Explain the concept of differential equations and methods for finding solutions of different types of differential equations and solve differential equations	Areas and Volumes			SLO137	State the formula to find the area bounded by a curve	Explanation with use of chalk and board Interactive lecture Practice exercise Group discussion	6 hrs	I
							SLO138	Estimate the area bounded by $y = f(x)$, the x-axis and ordinates $x=a$ and $x=b$			VI
							SLO139	Estimate the area bounded by the curve $y= f(x)$ & x-axis			VI
							SLO140	Estimate the area enclosed between two curves $y_1 =f_1(x)$, $y_2 =f_2(x)$			VI
							SLO141	State the formula to find the volume of solid of revolution			I
							SLO142	Apply formula to find the volume of solid of revolution			III
				Differential Equations			SLO143	Define Differential Equations using examples	Explanation with use of chalk and board Interactive lecture Practice exercise Group discussion	10 hrs	I
SLO144	Define order & degree of DE				I						
SLO145	State variable separable method				I						
SLO146	Solve differential equation by variable separable method				III						
SLO147	State method for solving linear DE of the type $\frac{dy}{dx} +Py =Q$	I									
SLO148	Solve linear D.E. of type $\frac{dy}{dx} +Py =Q$	III									
SLO149	State method for solving D.E. of the type $\frac{d^2y}{dx^2} =f(x)$	I									
SLO150	Solve D.E. of the type $\frac{d^2y}{dx^2} =f(x)$	III									

Mapping of CO to PO

	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PO ₆	PO ₇	PO ₈	PO ₉	PO ₁₀
CO1	3	3						2		
CO2	3	3						2		
CO3	3	3						2		
CO4	3	3						2		
CO5	3	3						2		
CO6	3	3						2		

3-Strongly map 2-Moderately mapped 1-Weakly mapped

Justification for CO-PO mapping

CO	Mapped POs	Justification
CO ₁	PO ₁	Vector algebra is part of basic mathematics and students get knowledge about different types of vectors, product of vectors, its properties, its applications which has a major role in solving engineering problems.
	PO ₂	Vector Algebra has great importance in all engineering subjects and students acquire the ability to apply the

		results in vector algebra in solving core or applied engineering problems.
	PO ₈	Problems related to vectors and its applications can be discussed in group also and students perform effectively as an individual, and as a member or leader in group discussions and solving problems.
CO ₂	PO ₁	Binomial expansion is one of the major topics in mathematics which is needed in different engineering subjects.
	PO ₂	Binomial expansion is needed in many areas of engineering and students acquire the ability to apply binomial expansion in solving engineering problems.
	PO ₈	Students perform effectively as an individual, and as a member or leader in group discussions and solving different types of problems related to binomial expansions.
CO ₃	PO ₁	Evaluation of determinants and its application in solving linear equations in two or three variables are used in solving engineering problems.
	PO ₂	Students acquire the ability to apply determinants and its applications in solving problems that may arise in various engineering fields.
	PO ₈	Determinants and related problems can be discussed in group so that students get more interested in the topic and hence they will perform effectively as an individual, and as a member or leader in group discussions and solving problems.
CO ₄	PO ₁	Matrix is part of basic mathematics and students acquire the knowledge of different types of matrices, operations in matrices and its application in solving equations which has important role in solving engineering problems.
	PO ₂	Matrices have great importance in various engineering fields and students will acquire the ability to apply results in matrices for solving engineering problems.
	PO ₈	Matrices and the related topics can be very interestingly discussed in group in classroom and students will perform effectively as an individual, and as a member or leader in group discussions and solving problems.

CO ₅	PO ₁	Integration is applicable in different engineering subjects and different methods of integration are very much important in solving engineering problems. Students will be able to find the indefinite integrals and definite integrals of any type of functions.
	PO ₂	Students acquire the ability to apply results in integration for solving core or applied engineering problems.
	PO ₈	Students perform effectively as an individual, and as a member or leader in group discussions and solving problems.
CO ₆	PO ₁	Applications of integration is very much important in almost all engineering branches and students will be able to apply it in solving engineering problems. Differential equations and different methods for finding its solutions are also applicable in various engineering subjects.
	PO ₂	Students acquire the ability to apply different methods of finding areas and volumes and finding solutions of differential equations in solving core or applied engineering problems.
	PO ₈	Students perform effectively as an individual, and as a member or leader in group discussions and solving problems.

Gaps in the Syllabus – To meet industry/profession requirements:

Sl.No.	Description	Proposed Action	Mapped POs/PSOs	Justification
1				

Contents beyond syllabus/Advanced Topics/Design:

Sl.No.	Description	Proposed Action	Mapped POs/PSOs	Justification
1				

Suggested Instructional/Learning Activities

1. Chalk & Talk
2. Active Lecturing
3. Group Discussion

Suggested Assessment Methodologies - Direct:

1. Attendance
2. Internal Series test
3. Assignments
4. Model Exam
5. End semester exam

Suggested Assessment Methodologies – In Direct:

1. Course End Survey
2. Student Feedback on Faculty

