GENERAL

all formula of first year engineering maths

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All Formula of First Year Engineering Maths: Your Ultimate Study Guide

First year engineering mathematics is the cornerstone of every engineering discipline. It equips students with the analytical tools needed to model real world problems, solve differential equations, analyze signals, and design systems. The sheer volume of formulas can feel overwhelming, but a well organized reference can transform confusion into confidence.

In this comprehensive article, we present **all formula of first year engineering maths**in a clean, searchable format. Each section covers the core topics—calculus, algebra, differential equations, linear algebra, trigonometry, vectors, probability, statistics, complex numbers, Laplace transforms, and miscellaneous series. By the end, you'll have a complete cheat sheet that you can use for exams, projects, or quick reviews.

1. Calculus Formulas

1.1 Limits and Continuity

- Limit Definition: limx!'a f(x) = L means for every ;Sã F†W&R Pxists ;Cã 7V6, F† B
- Continuity at a Point: f is continuous at a if limx!'a f(x) = f(a).

1.2 Differentiation

- Power Rule: d/dx (x •) = n xn 1
- Product Rule: (uv)'' = u''v + uv''
- Quotient Rule: (u/v)'' = (u''v – uv'')/v²
- Chain Rule: d/dx f(g(x)) = f''(g(x))·g''(x)
- Implicit Differentiation: Differentiate both sides w.r.t. x treating y as a function of x.
- Second Derivative Test: f""(x)0 !' local min.

1.3 Integration

- Indefinite Integral: "+f(x)dx = F(x) + C, where F''(x)=f(x).
- Definite Integral (Fundamental Theorem of Calculus): "+ab f(x)dx = F(b) – F(a).
- Integration by Parts: "+u dv = uv – "+v du.
- Partial Fractions: Decompose rational functions into simpler fractions.
- Substitution: "+f(g(x))g''(x)dx = "+f(u)du, where u = g(x).

1.4 Multivariable Calculus

- Partial Derivative: " f/" x = limh!'0 [f(x+h,y) – f(x,y)]/h.
- Gradient: " f = (" f/" x, " f/" y, " f/" z).
- Line Integral: "+C f(x,y)ds = "+ab f(x(t),y(t))" (x''² + y''²)dt.
- Surface Integral: "+"+S f(x,y,z)dS = "+"+D f(r(u,v)) ru × rv dudv.
- Divergence Theorem: "+"+S (" ·F)dS = "-V (" ·F)dV.
- Stokes' Theorem: ".C F·dr = "+"+S (" ×F)·n dS.

2. Algebraic Formulas

2.1 Quadratic Formula

Solution of ax² + bx + c = 0: x = [–b ± " (b² – 4ac)]/(2a).

2.2 Matrix Operations

- Matrix Addition/Subtraction: (A ± B)ij = Aij ± Bij.
- Scalar Multiplication: (kA)ij = k·Aij.
- Matrix Multiplication: (AB)ij = :6² –´&¶¢ †öæÇ' –b 6öÇVÖç2 öb Ò &ðws of B).
- Transpose: (AT)ij = Aji.
- Determinant (2×2): |A| = ad – bc.
- Determinant (3×3): |A| = a(ei – fh) – b(di – fg) + c(dh – eg).

2.4 Eigenvalues and Eigenvectors

- Characteristic Equation: |A – ;´—Â Ò à
- Eigenvector Equation: (A – ;´'—b Ò à

2.5 Cramer's Rule

For system Ax = b with det(A) "` 0:

x_i = |A_i| / |A|, where Ai is matrix A with its i-th column replaced by vector b.

3. Differential Equations

3.1 First Order Equations

- Separable: dy/dx = g(x)h(y) !Ò "+dy/h(y) = "+g(x)dx.
- Linear: dy/dx + P(x)y = Q(x) !Ò ;Â‡,“ÖR"µ ‡,–G,Â 6öÇWF–öâ ' Ò ƒ ó¼)"+;Å G, ² 2ó¼.
- Integrating Factor: ;Â‡,“ÖR"µ ‡,–G,à

3.2 Second Order Linear Equations

- Homogeneous Constant Coefficients: y 3 + ay 2 + by = 0, characteristic r² + ar + b = 0.
- Particular Solution (Undetermined Coefficients): Assume form based on RHS.
- Variation of Parameters: yp = –y1"+y2g/W dx + y2"+y1g/W dx.

4. Linear Algebra

4.1 Vector Operations

- Dot Product: u·v = :2 V—f' Ò ÇWÇÇgÆ6÷3¸.
- Cross Product (3D): u × v = (u2v3 – u3v2, u3v1 – u1v3, u1v2 – u2v1).
- Magnitude: v = " (:2 f›'"'à
- Projection: projuv = (u·v / u ²) u.

4.2 Matrix Inverse

For 2×2 matrix A = [[a, b], [c, d]]:

A^{–1} = (1/(ad – bc)) [[d, –b], [–c, a]] if ad – bc "` 0.

4.3 Rank and Nullity

Rank(A) + Nullity(A) = n (number of columns).

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