Course Name: 03 Years Diploma in Mining Engineering

Year   : First

Subject Title: Engineering Mathematics

Subject Code: M102

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03			100	80	20	26	40	3 Hrs

NOTE:

1. Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

Rationale:

Mathematics provides foundation for all engineering subjects. In this paper "Engineering Mathematics" students will be taught basic facts, concepts and principles of mathematics as a tool to analyze engineering problems. The study this subject will help to develop the skills essential for new emerging avenues.

Objective:

The student will be able to acquire knowledge of mathematical terms, concepts and principles. They can acquire sufficient mathematical techniques and can develop the ability to apply mathematical methods to solve technical and day to day practical problems. This subject will also help the students to develop logical thinking, which is useful in comprehending the principles of all other subjects. Analytical and systematic approach towards any problem is developed through learning of this subject.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
	ALGEBRA		

	1.1 Prerequsites
	     Revision of
	   1.1.1 Arithmetic, Geometric and Harmonic Progressions,
	   1.1.2 Formula of nth term and sum to n-terms of A.P. and G.P.
	   1.1.3 Expression of $\sum n^2$ and $\sum n^3$.
	   1.1.4 Quadratic equations with real coefficients and relation between their roots & coefficient
		1	1

	1.2 Logarithms:
	   1.2.1 Definition of logarithm (Natural and Common logarithm.)
	   1.2.2 Laws of logarithm
	   1.2.3 Examples based on 1.2.1 to 1.2.2
		2	3

1	**1.3 PARTIAL FRACTION**
	   1.3.1 Definition of polynomial fraction proper & improper
	      Fractions and definition of partial fractions.
	   1.3.2 To Resolve proper fraction into partial fraction with
	      denominator containing non repeated linear factors,
	      repeated linear factors and irreducible non repeated
	      Quadratic factors.
	   1.3.3 To resolve improper fraction into partial fraction.
		2	3

	1.4 DETERMINANT AND MATRICES.
	     Determinant
	   1.4.1 Definition and expansion of determinants of order
	      2 and 3.
	   1.4.2 Cramer's rule to solve simultaneous equations for
	      2 and 3 unknowns.
	     Matrices
	   1.4.3 Definition of a matrix of order m X n and types of
	      Matrices with examples.
	   1.4.4 Algebra of matrices such as equality, addition,
	      Subtraction, scalar multiplication and multiplication.
	   1.4.5 Transpose of a matrix.
	   1.4.6 Minor, cofactor of an element of a matrix, adjoint of
	      matrix and inverse of matrix by adjoint method.
		6	8

	1.4 BINOMIAL THEOREM	3	4
	1.4.1 Definition of factorial notation, definition of permutation and combinations with formula (without proof).		
	1.4.2 Derivation of simple identities and solution based on it.		
	1.4.3 Binomial theorem for positive index.		
	1.4.4 General term, Middle term, independent term and coefficient of x^n		
2	**TRIGONOMETRY.**		
	2.1 REVISION	1	1
	2.1.1 Measurement of an angle (degree and radian). Relation between degree and radian.		
	2.1.2 Trigonometrical ratios of 0^0, 30^0, 45^0, 60^0, 90^0, $90^0 \pm \theta$, $180^0 \pm \theta$ and $360^0 \pm \theta$		
	2.1.3 Fundamental identities.		
	2.2 TRIGONOMETRIC RATIOS OF ALLIED, COMPOUND, MULTIPLE & SUBMULTIPLE ANGLES (Questions based on numerical computations, which can also be done by calculators, need not be asked particularly for allied angles).	5	6
	2.3 Transformation formula of Product into sums or difference and vice versa, simple problems based on it		
	2.4 INVERSE TRIGONOMETRIC RATIOS 2.4.1 Definition of inverse trigonometric, ratios, Principal values of inverse trigonometric ratios. 2.4.2 Relation between inverse trigonometric ratios.		
3	**COORDINATE GEOMETRY**	8	10
	3.1 POINT AND DISTANCES 3.1.1 Distance formula, Section formula, midpoint, centroid of triangle. 3.1.2 Area of triangle and condition of collinearity.		
	3.2 STRAIGHT LINE 3.2.1 Slope and intercept of straight line. 3.2.2 Equation of straight line in slope point form, slope-intercept form, two-point form, two-intercept form, normal form. General equation of line. 3.2.3 Angle between two straight lines condition of parallel and perpendicular lines. 3.2.4 Intersection of two lines. 3.2.5 Length of perpendicular from a point on the line and		

	perpendicular distance between parallel lines.		

	3.3 CIRCLE
	   3.3.1 Equation of circle in standard form, centre – radius
	           form, diameter form, two – intercept form.
	   3.3.2 General equation of circle, its centre and radius, simple problem		

4	**VECTORS** 4.1 Definition of vector, position vector, Algebra of vectors (Equality, addition, subtraction and scalar multiplication) 4.2 Dot (Scalar) product with properties. 4.3 Vector (Cross) product with properties.	6	8

05	Function, Limit and Continuity
	
	Function
	
	   5.1.1 Definitions of variable, constant, intervals such as open, closed, semi-open etc.
	
	   5.1.2 Definition of Function, value of a function and types of functions, Simple Examples.
	
	    5.1.3 Definition of sinh x, cosh x and tanh x and some hyperbolic identities.
	
	5.2 **Use the concepts of Limit and Continuity for solving the problems**
	
	5.2.1 The concept and meaning of $\lim_{x\to a} f(x)=l$ and the properties of limits.
	
	5.2.2 Mention the Standard limits $\lim_{x\to a}\dfrac{x^n-a^n}{x-a}$, $\lim_{x\to 0}\dfrac{\sin x}{x}$,
	
	$\lim_{x\to 0}\dfrac{\tan x}{x}$, $\lim_{x\to 0}\dfrac{a^x-1}{x}$, $\lim_{x\to 0}\dfrac{e^x-1}{x}$, $\lim_{x\to 0}(1+x)^{\frac{1}{x}}$, $\lim_{x\to\infty}\left(1+\dfrac{1}{x}\right)^x$ etc.
	
	5.2.3 Evaluate the limits of the type $\lim_{x\to\infty}\dfrac{f(x)}{g(x)}$
	
	5.2.4 Simple example on Limits of algebraic, trigonometric, exponential and logarithmic functions.
	
	5.3 Concept of continuity of a function at a point and in interval with some examples related to "whether a given function is continuous or not".
		8	10

06	6. **Differentiation and its meaning in engineering situations** 6.1 Concept of derivative of a function $y = f(x)$ from first principle as $\lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$ And standard notations to denote the derivative of a function. 6.2 Derivatives of elementary functions like x^n, a^x, e^x, log x, sin x, cos x, tanx, secx, cosecx, cot x and inverse circular function using the first principles. 6.3 Rules for differentiation of sum, difference, scalar multiplication, product and quotient of functions with illustrative and simple examples. 6.4 Differentiation of a function of a function (Chain rule) with illustrative examples such as (i) $\sqrt{t^2 + \dfrac{2}{t}}$ (ii) $x^2 \sin 2x$ (iii) $\dfrac{x}{\sqrt{x^2 + 1}}$ (iv) $\log(\sin(\cos x))$. 6.5 Derivatives of Inverse Trigonometric functions and some examples using the Trigonometric transformations. 6.6 Differentiation of a function with respect to another function and also differentiation of parametric functions with examples. 6.7 Derivative of some simple hyperbolic functions (without proof). 6.8 Differentiation of implicit function with examples. 6.9 Differentiation of Logarithmic function with examples like $[f(x)]^{g(x)}$. 6.10 Concept of higher order derivatives (second and third order) with examples. 6.11 Concept of function of several variables. Partial differentiation and difference between the ordinary and partial derivatives with simple examples.	10	16

07	**7. Applications of the Differentiation** 7.1 Geometrical Meaning of Derivatives 7.1.1 State the geometrical meaning of the derivative as the slope of the tangent to the curve y=f(x) at any point on the curve. 7.1.2 Concept of slope of tangent. Equation of tangent and normal to the curve y=f(x) at any point on it. 7.1.3 Angle between two curves with illustrative examples. 7.2 Use Derivatives to find extreme values of functions. 7.2.1 Concept of increasing and decreasing functions. 7.2.2 Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples. 7.2.3 Extreme values (maxima or minima) of a function of single variable - simple problems yielding maxima and minima. 7.3 Concept of Derivatives as Rate Measure 7.3.1 Problems based on Rates and Motion 7.4 Use Derivatives to find Radius of Curvature.		8	10
			60	80
		Total		

Tutorial: Tutorials are to be used to get enough practice for solving problems. It is suggested that in each tutorial at least five problems to be solved.

Learning Resources:

Books:

Sr. No	Title	Authors	Publications
1	Mathematics: A Textbook for Class XI Part I &II	National Council of Educational Research and Training	
2	Mathematics: A Textbook for Class XII Part I &II	National Council of Educational Research and Training	
3	Mathematics for Class XI Volume I and II	R. D. Sharma	Dhanpat Rai Publication, New Delhi.

4	Mathematics for Class XII Volume I and II	R. D. Sharma	Dhanpat Rai Publication, New Delhi.
5	Higher Engineering Mathematics	B.S Grewal	Khanna Publication, New Delhi
6	Senior Secondary School Mathematics for XI & XII.	R S Agarwal	Bharti Bhawan

Note:

In board examination, question setter may be advised to select 20% questions of objective, 30% of short type and remaining 50% of long type based on basic concepts, formula and calculations respectively.

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