

# Applied Mathematics - I

F.E. Sem. I

## EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	80
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25
Internal Assessment	–	20

## SYLLABUS

**Prerequisite :** Review on Complex Number-Algebra of Complex Number, Different representations of a Complex number and other definitions, D'Moivre's Theorem.

### Module -1 Complex Numbers

- 1.1 Powers and Roots of Exponential and Trigonometric Functions.
- 1.2 Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Logarithmic functions.
- 1.3 Separation of real and Imaginary parts of all types of Functions.
- 1.4 Expansion of  $\sin^n \theta$ ,  $\cos^n \theta$  in terms of sines and cosines of multiples of  $\theta$  and Expansion of  $\sin n\theta$ ,  $\cos n\theta$  in powers of  $\sin \theta$ ,  $\cos \theta$ .

### Module -2 Matrices and Numerical Methods

- 2.1 Types of Matrices (symmetric, skew - symmetric, Hermitian, Skew Hermitian, Unitary, Orthogonal Matrices and properties of Matrices). Rank of a Matrix using Echelon forms, reduction to normal form, PAQ forms, system of homogeneous and non -homogeneous equations, their consistency and solutions. Linear dependent and independent vectors.
- 2.2 Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (Review) (2) Gauss Jordan Method (3) Crout's Method (LU) (4) Gauss Seidel Method and (5) Jacobi iteration (Scilab programming for above methods is to be taught during lecture hours)

### Module -3 Differential Calculus

- 3.1 Successive differentiation :  $n^{\text{th}}$  derivative of standard functions. Leibnitz's Theorem (without proof) and problems.
- 3.2 Partial Differentiation : Partial derivatives of first and higher order, total differentials, differentiation of composite and implicit functions.
- 3.3 Euler's Theorem on Homogeneous functions with two and three independent variables (with proof). Deductions from Euler's Theorem.

### Module -4 Application of Partial Differentiation, Expansion of Functions, Indeterminate Forms and Curve Fitting

- 4.1 Maxima and Minima of a function of two independent variables. Lagrange's method of undetermined multipliers with one constraint. Jacobian, Jacobian of implicit function. Partial derivative of implicit function using jacobian.

- 4.2 Taylor's Theorem (Statement only) and Taylor's series, Maclaurin's series (Statement only). Expansion of  $e^x$ ,  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $\sinh x$ ,  $\cosh x$ ,  $\tanh x$ ,  $\log(1+x)$ ,  $\sin^{-1} x$ ,  $\cos^{-1} x$ , Binomial series. Indeterminate forms, L-Hospital Rule, problems involving series also.
- 4.3 Fitting of curves by least square method for linear, parabolic, and exponential. Regression Analysis (to be introduced for estimation only)
- (Scilab programming related to fitting of curves is to be taught during lecture hours)**

### Mumbai University Question Paper Format :

- 1) Question paper will comprise of 6 questions, each carrying 20 marks.
- 2) Total 4 questions need to be solved.
- 3) Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
- 4) Remaining question should be randomly selected from all the modules.
- 5) Weightage of marks should be proportional to number of hours assigned to each module.

### Content wise 'Blue-Print' of Applied Maths – I

Module No.	Topic No.	Topic Title**	Topic wise Marks	Module wise Marks
1	1.1	Complex Numbers- Powers & Roots	06	29
	1.2	Complex Numbers- Circular Functions	09	
	1.3	Separation of real & imaginary parts	08	
	1.4	Expansion of sine and cosine, etc	06	
2	2.1	Types of Matrices	16	30
	2.2	Matrices-Linear algebraic equations	14	
3	3.1	Successive Differentiation	12	29
	3.2	Partial Differentiation	09	
	3.3	Euler's Theorem	08	
4	4.1	Partial Differentiation: Maxima & Minima	15	32
	4.2	Taylor's Theorem	09	
	4.3	Fitting of Curves	08	
	<b>Total</b>			<b>120</b>

(\*\*Topic titles are written in brief)

### 'Blue-Print' of question paper of Applied Maths – I

1	a	1.2 (03 marks) Relation between circular and hyperbolic function
	b	3.2 (03 marks) Problems on basic partial derivatives
	c	4.1 (03 marks) Jacobians
	d	4.2 (03 marks) Expansion standard series
	e	2.1 (04 marks) Properties of matrices
	f	3.1 (04 marks) Problems on std formula of successive derivatives
2	a	1.1 (06 marks)
	b	2.1 (06 marks) Matrices PAQ/normal form
	c	3.3 (08 marks) Euler's theorem with deduction
3	a	2.1 (06 marks) Linear homo and non homogenous equations.
	b	4.1 (06 marks) Maxima and minima/Lagranges method
	c	1.3 (08 marks)

4	a	4.1 (06 marks) Jacobian of implicit functions/partial derivative of implicit functions using jacobian.
	b	1.2 (06 marks) Logarithm of complex numbers
	c	2.2 (08 marks)
5	a	1.4 (06 marks)
	b	4.2 (06 marks ) Expansion of series/indeterminate forms
	c	3.1 (08 marks ) Problems on Leibnitz's theorem
6	a	2.1/2.2 (06 marks) Linear independent,dependent/from 2.2
	b	3.2 (06 marks) Composite/implicit functions
	c	4.3 (08 marks) Fitting of curves/Regression

**NOTE:** (1) Each Question of 8 marks may be converted into two questions of 4 marks each  
(2) **NO** question on correlation coefficient is expected.  
(3) Programmable calculators are **NOT** allowed.

### Distribution of Marks

Module	Topic No.	Weightage	Q.1 (Compulsory)	Q.2 (Optional)	Q.3 (Optional)	Q.4 (Optional)	Q.5 (Optional)	Q.6 (Optional)
1	1.1	06		06				
	1.2	09	03			06		
	1.3	08			08			
	1.4	06					06	
2	2.1	16	04	06	06			
	2.2	14				08		06
3	3.1	12	04				08	
	3.2	09	03					06
	3.3	08		08				
4	4.1	15	03		06	06		
	4.2	09	03				06	
	4.3	08						08
	<b>Total</b>	<b>120</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>

