

GUJARAT TECHNOLOGICAL UNIVERSITY



Program Name: Engineering

Level: Degree

Branch: All

Subject Code : BE02R00011

Subject Name : Mathematics – 2

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	BSC

Prerequisite:	Basic Algebra, Complex Algebra, Calculus.
Rationale:	Mathematics fundamental necessary to formulate, solve and analyze engineering problems. Complex analysis not only provides insight into mathematical theory but also has practical applications in engineering, physics and many other forms.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	The essential tool of matrices and linear algebra in a comprehensive manner.	A
02	The effective mathematical tools for the solutions of differential equations that model physical processes.	A
03	The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.	A
04	To find Laurent's series, poles, residues, and apply Cauchy Residue theorem in evaluating some real integrals.	A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH		Theory		Tutorial / Practical			
						ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
30	30	0	60	120	04	70	30	0	30	0	130

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, PA = Progressive Assessment, ESE = End-Semester Examination

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Module 1: Matrices: Linear Independence; Row Echelon form (REF) and Reduced Row Echelon form (RREF) of a Matrix, Rank of a Matrix using REF/RREF; Inverse of a matrix using Gauss-Jordan method; Solution of System of linear equations by elementary row operations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Inverse of a Matrix by Cayley-Hamilton Theorem.	6	20%
2.	Module 2: First order ordinary differential equations: Exact differential equations, Integrating factors for non-Exact differential equations, linear and Bernoulli's equations. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5	15%
3.	Module 3: Ordinary differential equations of higher orders: Higher order linear differential equations with constant and variable coefficients, Euler-Cauchy equations, solution by variation of parameters, method of undetermined coefficients; Classification of Ordinary and Singular points, Power series solutions for ordinary points.	7	25%
4.	Module 4: Complex Variables (Differentiation): Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; analyticity of elementary functions (exponential, trigonometric, logarithm) and their properties;	6	20%
5.	Module 5: Complex Variables (Integration): Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Rouché's theorem.	6	20%
	Total	30	100

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Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
20	35	15	0	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
9. Howard Anton, Irl Bivens, Stephens Davis, Calculus, 10e, Wiley, 2016.
10. AICTE's Prescribed Textbook: Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable), Khanna Book Publishing Co.

(b) Open source software and website:

1. MIT Open Courseware (https://ocw.mit.edu/search/?s=department_course_numbers.sort_coursesum)
2. NPTEL Open Courseware (<https://nptel.ac.in/>)

• List of suggested activities for Problem Based Learning:

Activity	No. of Hours	Total Hours Claimed	Evaluation Criteria
Assignments on topics like Matrices, Rank, Inverse, Solution of system of linear equations, Eigen values and corresponding vectors, first order and higher order differential equations, complex analysis, Analytic function,	Completing 10 assignments (3h each)	30	Evaluated based on assignment submission

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harmonic function, Cauchy-Integral theorem, Residues etc.			
Study-watching online videos available for the content on NPTEL like platforms	10 hrs. for video watching and 5hr. for report preparation	15	Evaluated based on report
Online quiz participation in 2 quizzes	9 hr. for each quiz preparation and 1 hr. for each quiz participation.	20	Evaluated on the base of quiz result
(Optional) Online Course (MOOC/NPTEL/SWAYAM/etc.) on Complex analysis	Minimum course duration of 10 hours	10	Assessment through an examination at the end of the course. Certificate submission required
AI based content development related to application of Ordinary Differential equations or Complex Analysis.	5 hours per unit	20	Review based on evaluation of content
Developing Posters, Charts, or PowerPoint Presentations on Subject related Technical Topics	Designing and presenting visual content	15	Assessed based on creativity, clarity, and presentation skills

Guidelines for Faculty :

- (1) The activities listed above are suggestive, and faculty members have the flexibility to select and modify them as needed.
- (2) The total self-learning hours remain fixed at 60 hours, ensuring comprehensive coverage of topics of Mathematics 02.
- (3) Faculty can adjust the distribution of hours across different activities while maintaining a balanced learning approach.
- (4) All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- (5) Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective recordkeeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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