GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Degree

Branch: All

Course / Subject Code : BE01R00041

Course / Subject Name : Mathematics – 1

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

Prerequisite:	Basic Algebra, Geometry, Trigonometry and Calculus
Rationale:	The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	To apply differential and integral calculus to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.	A
02	The fallouts of Taylor's and Maclaurin's Theorem that is fundamental to application of analysis to Engineering problems.	A
03	The tool of Sequences and Infinite series for learning advanced Engineering Mathematics.	A
04	To deal with functions of several variables that is essential in most branches of engineering.	A
05	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.	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
						Theory		Tutorial / Practical			
L	T	P	TW/ SL	TH		ESE (E)	PA (M)	PA/ (I)	TW/ SL (I)	ESE (V)	
30	30	00	60	120	04	70	30	00	30	00	130

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

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Module 1: Basic Calculus:** Evaluation of improper integrals of Type-I and Type-II, Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions	9	20%
2.	**Module 2: Single-variable Calculus (Differentiation):** Taylor's and Maclaurin's theorem for a function of one variable, Taylor's and Maclaurin's series of a function using statement of the theorems; Extreme values of functions; Indeterminate forms and L' Hospital's rule.	9	20%
3.	**Module 3: Sequences and series:** Sequence of numbers and its convergence, Infinite series; Tests for convergence (Telescoping series, Geometric series test, Integral test, p-test, comparison test, D' Alembert's ratio test, Cauchy's root test), Alternating series test; Power series, Radius and interval of convergence, Conditional and Absolute convergence of a power series	9	20%
4.	**Module 4: Multivariable Calculus (Differentiation):** Limit, Continuity and Differentiation for function of two or more variables, total derivative, gradient, directional derivatives; Tangent plane and Normal line to the surface $f(x, y, z) = c$; Extreme values for function of two variables (Maxima, minima and saddle points); Method of Lagrange multipliers.	9	20%
5.	**Module 5: Multivariable Calculus (Integration):** Multiple Integration: Double integrals (Cartesian, Polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian, Cylindrical, Spherical).	9	20%
	Total	**45**	**100**

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. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
4. AICTE's Prescribed Textbook: Mathematics-I (Calculus & Linear Algebra), Khanna Book Publishing Co.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

(b) Open source software and website:

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

Suggested Self-Learning Activities

Activity	No. of Hours	Total Hours Claimed	Evaluation Criteria
Assignments on topics like Improper integrals, beta -gamma function, application of integration, Taylor's and Maclaurin's series, Infinite sequence and series, Partial differentiation, application of partial differentiation and multiple integrals, application of multiple integration etc	Completing ten assignments (2h each)	20	Evaluated based on assignment submission
Online Video based learning	Duration of video = 20h	30	Report or presentation based on learning

	Report preparation = 10h		through video
Online participation in two Quizzes	4 hours for preparation of each quiz and 1 hour for participation in each quiz,	10	Quiz Scores
Online Course (MOOC/NPTEL/SWAYAM/edX, etc.) on Calculus	Minimum course duration of 10 hours	10	Assessment through an examination at the end of the course. Certificate submission required
AI based content development on Subject related topics	5 hours per unit	20	Review based on evaluation of content
Prepare project on Subject related topics	10 hours per project	10	Review based on evaluation of project .
Developing Posters, Charts, or PowerPoint Presentations on Subject related topics	Designing and presenting visual content	20	Assessed based on creativity, clarity, and presentation skills

Guidelines for Faculty:

- The activities listed above are suggestive and faculty members have the flexibility to select and modify them as needed.
- The total self-learning hours remain fixed at 60 hours, ensuring comprehensive coverage of topics of Mathematics -I through at least 3 activities.
- Faculty can adjust the distribution of hours across different activities while maintaining a balanced learning approach.
- 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.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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