

LOK JAGRUTI UNIVERSITY (LJU)

INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering (710)

Bachelor of Engineering (B.E.) – Semester – I

Course Code:	017101191
Course Name:	Mathematics - I
Category of Course:	Basic Science Course (BSC)
Prerequisite Course:	---

Teaching Scheme				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
3	1	0	4	40

Syllabus				
Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	Basic Algebra	---	Gas Laws (017103301-Unit-3), Various Non-flow Processes (017103301-Unit-4), First Law Applied to Flow Processes (017103403-Unit-3), Limitations and Applications of Second Law of Thermodynamics (017103403-Unit-5), Vapor Power Cycles (017103403-Unit-7), Dimensional Analysis (017103491-Unit-7)	2 (5%)
	1.1 Indices			
	1.2 Surds			
	1.3 Expansions and factorization			
	1.4 Logarithm			
02	Trigonometry and Geometry	---	Belt Drives (017103502-Unit-5), Theory of Metal Cutting (017103302-Unit-2), Metal Shaping and Forming Process (017103401 -Unit-8), Static Forces on Surface (017103491 - Unit-3), Buoyancy and Metacentric Height (017103491 - Unit-4), Impact of Jet (017103501-Unit-2), Thermal Radiation: Basic Relations (017103591- Unit-7)	3 (7.5%)
	2.1 Angles			
	2.2 Trigonometric functions And Hyperbolic functions			
	2.3 Trigonometric functions of sum and difference of two Angles			
	2.4 Inverse trigonometric functions			
	2.5 Law of sines and cosines			
	2.6 Area of geometric curves			
2.7 Volume of geometric curves				
03	Basic Differentiation and Integration	---	Shear Force and Bending Moment (017103391 - Unit-4), Flexural Stresses (017103391-Unit-5), Shear Stresses (017103391-Unit-6), Cam (017103392-Unit-7), Friction Devices: Clutches (017103502- Unit-7), Various Non-flow Processes (017103301-Unit-4), First Law of Thermodynamics (017103403- Unit-2), Basic Concepts of Entropy (017103403-Unit-6), Static Forces on Surface (017103491-Unit-3), Buoyancy and Metacentric Height (017103491- Unit-4), Viscous and Turbulent Flow (017103491-Unit-10), Impact of Jet (017103501 -Unit-2), Reciprocating Compressor (017103501 -Unit-6), Conduction: 1-D Steady State Heat Conduction (017103591 -Unit-2), Conduction: Unsteady State Heat Conduction (017103591-Unit-3), Heat Transfer from Extended Surface (017103591-Unit-4), Heat Exchangers (017103591-Unit-6)	3 (7.5%)
	3.1 Basic differentiation by formulae			
	3.2 Product and quotient rule			
	3.3 Chain rule and composite function			
	3.4 Basic integration by formulae			
	3.5 Integration by parts			
	3.6 Roll's theorem			
	3.7 Lagrange's theorem			
	3.8 Cauchy's mean value theorem			
3.9 Indeterminate forms and L'Hospital's rule				
04	Sequence and Series	Basic Differentiation and Integration (017101191-Unit-3)		8 (20%)
	4.1 Convergence and divergence of sequences			
	4.2 Sandwich theorem for sequences			
	4.3 Continuous function theorem for sequences, bounded monotonic sequences			
	4.4 Convergence and divergence of an infinite series.			
4.5 Geometric series, telescoping series, combining series,				

	harmonic series			
	4.6 Integral test and P- series test		---	
	4.7 Comparison test			
	4.8 Ratio test, Raabe's test			
	4.9 Root test, alternating series test			
	4.10 Absolute and conditional convergence			
	4.11 Radius of convergence of a power series			
	4.12 Taylor's series			
	4.13 Maclaurin's series			
	Partial Derivatives			
05	5.1 Functions of several variables	Basic Differentiation and Integration (017101191-Unit-3)	First Law Applied to Flow Processes (017103403 -Unit-3)	5 (12.5%)
	5.2 Geometric interpretation of partial derivatives			
	5.3 Limits and continuity of function of several variables			
	5.4 First and higher order partial derivatives			
	5.5 Euler's theorem and modified Euler's theorem			
	5.6 Total derivatives and chain rule			
	5.7 Implicit function			
	Application of Partial Derivatives			
06	6.1 Tangent plane and normal line	Partial Derivatives (017101191 -Unit-5)	---	4 (10%)
	6.2 Total differentiation and approximation			
	6.3 Extreme values			
	6.4 Method of Lagrange multipliers.			
	6.5 Jacobian			
	Curve Tracing			
07	7.1 Concavity & convexity of curve	---	---	3 (7.5%)
	7.2 Point of inflection			
	7.3 Maximum and minimum of a function			
	7.4 Tracing of cartesian curve			
	7.5 Curve's in parametric form			
	7.6 Tracing of polar curves			
	7.7 Radius of curvature of parametric curve			
	Multiple Integral			
08	8.1 Double integral over rectangles and general regions	Basic Differentiation and Integration (017101191-Unit-3), Curve tracing (017101191-Unit-8)	---	7 (17.5%)
	8.2 Change of order of integration			
	8.3 Double integration in polar coordinates			
	8.4 Change of variables in double integration by Jacobian			
	8.5 Triple integration			
	8.6 Area enclosed by plane curve using double integration			
	8.7 Triple integration in cylindrical and spherical co-ordinates			
	Application of Multiple Integral			
09	9.1 Mass of a plate(lamina) by double integration	Multiple Integral (017101191 – Unit-8)	---	2 (5%)
	9.2 Mass of a solid by triple integration			
	9.3 Moment and center of mass by double integration			
	Complex Numbers			
10	10.1 Complex numbers	Trigonometric functions (017101191-Unit-2)	---	3 (7.5%)
	10.2 Geometrical representation of complex numbers			
	10.3 Algebra of complex numbers			
	10.4 Different forms of complex numbers			
	10.5 Modulus and argument (or amplitude) of complex Numbers			
	10.6 Properties complex numbers			
	10.7 De Moivre's theorem			
	10.8 Circular and hyperbolic functions			
	10.9 Logarithm of a complex number			

**Proposed Theory + Practical Evaluation Scheme by Academicians
(% Weightage Category Wise and it's Marks Distribution)**

L: 3 T: 1 P: 0

**Note: In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.
Each Test will be of 25 Marks.
Each Test Syllabus Weightage: Range should be 20% - 30%**

Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage	
Theory	4	4	MCQ	15%	15	
Theory			Theory Descriptive	0%	0	
Theory			Formulas and Derivation	10%	10	
Theory			Numerical	75%	75	
Expected Theory %	100%			Calculated Theory %	100%	100
Practical	0		Individual Project	0%	0	
Practical			Group Project	0%	0	
Practical			Internal Practical Evaluation (IPE)	0%	0	
Practical			Viva	0%	0	
Practical			Seminar	0%	0	
Expected Practical %	0%		Calculated Practical %	0%	0	
Overall %	100%			100%	100	

Course Outcome

Upon completion of the course students will be able to

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| 1 | To solve problems of differentiation, Integration and Trigonometry. Also, how to apply it to the various problems in engineering. |
| 2 | To apply the various tests of convergence to sequence, series and the tool of power series for learning advanced Engineering Mathematics. |
| 3 | To solve some practical problems, such as constrained optimization problems and other problems involving Partial differentiation and to calculate directional derivatives and gradients. |
| 4 | Evaluate a double integral in polar coordinates and triple integral to find area and volume in rectangular coordinates, cylindrical coordinates, and spherical coordinates Also, to evaluate exponential, trigonometric and hyperbolic functions for a complex number. |

Suggested Reference Books

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| 1 | Calculus with Early Transcendental Functions, James Stewart, Cengage Learning. |
| 2 | Thomas' Calculus, Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education. |
| 3 | Advanced Engineering Mathematics, Erwin Kreysig, Wiley Publication. |
| 4 | Linear Algebra and its Applications, Gillbert Strang, Cengage Learning(RS), 4 th edition(2005) |
| 5 | Higher Engineering Mathematics, B.S.Grewal, Khanna Publishers. |

List of Open-Source Software/Learning website

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| 1 | https://nptel.ac.in |
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