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** 1.1 Indices 1.2 Surds 1.3 Expansions and factorization 1.4 Logarithm	---	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%)
02	**Trigonometry and Geometry** 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	---	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%)
03	**Basic Differentiation and Integration** 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	---	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%)
04	**Sequence and Series** 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,	Basic Differentiation and Integration (017101191-Unit-3)		8 (20%)

	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			
05	**Partial Derivatives**	Basic Differentiation and Integration (017101191-Unit-3)	First Law Applied to Flow Processes (017103403 -Unit-3)	**5 (12.5%)**
	5.1 Functions of several variables			
	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			
06	**Application of Partial Derivatives**	Partial Derivatives (017101191 -Unit-5)	---	**4 (10%)**
	6.1 Tangent plane and normal line			
	6.2 Total differentiation and approximation			
	6.3 Extreme values			
	6.4 Method of Lagrange multipliers.			
	6.5 Jacobian			
07	**Curve Tracing**	**---**	---	**3 (7.5%)**
	7.1 Concavity & convexity of curve			
	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			
08	**Multiple Integral**	Basic Differentiation and Integration (017101191-Unit-3), Curve tracing (017101191-Unit-8)	---	**7 (17.5%)**
	8.1 Double integral over rectangles and general regions			
	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			
09	**Application of Multiple Integral**	Multiple Integral (017101191 – Unit-8)	---	**2 (5%)**
	9.1 Mass of a plate(lamina) by double integration			
	9.2 Mass of a solid by triple integration			
	9.3 Moment and center of mass by double integration			
10	**Complex Numbers**	Trigonometric functions (017101191-Unit-2)	---	**3 (7.5%)**
	10.1 Complex numbers			
	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
1	Understand the concept of basic mathematics and continuous and differential functions and its application to daily life.
2	To predict the life of machine, components, subject to random sequence using sequence and series in mechanical engineering.
3	To model physical phenomena including fluid dynamics, heat transfer and structure mechanics using partial derivatives.
4	Understand the complex numbers and Calculate Area and Volumes using multiple integrals of particular structure and mechanics, which is the determination of properties of plane and solid bodies.
Suggested Reference Books	
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), 4th edition(2005)
5	Higher Engineering Mathematics, B.S.Grewal, Khanna Publishers.

List of Open-Source Software/Learning website	
1	https://nptel.ac.in