MAT1011	Calculus for Engineers	L	T	P	J	C
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Pre-requisite		**Syllabus Version**				
		1.0				

Course Objectives :

1. To provide the requisite and relevant background necessary to understand the other important engineering mathematics courses offered for Engineers and Scientists.
2. To introduce important topics of applied mathematics, namely Single and Multivariable Calculus and Vector Calculus etc.
3. To impart the knowledge of Laplace transform, an important transform technique for Engineers which requires knowledge of integration

Expected Course Outcomes:

At the end of this course the students should be able to

1. apply single variable differentiation and integration to solve applied problems in engineering and find the maxima and minima of functions
2. understand basic concepts of Laplace Transforms and solve problems with periodic functions, step functions, impulse functions and convolution
3. evaluate partial derivatives, limits, total differentials, Jacobians, Taylor series and optimization problems involving several variables with or without constraints
4. evaluate multiple integrals in Cartesian, Polar, Cylindrical and Spherical coordinates.
5. understand gradient, directional derivatives, divergence, curl and Greens', Stokes, Gauss theorems
6. demonstrate MATLAB code for challenging problems in engineering

Student Learning Outcome (SLO):	**1, 2, 9**

Module:1	**Application of Single Variable Calculus**	**9 hours**

Differentiation- Extrema on an Interval-Rolle's Theorem and the Mean Value Theorem-Increasing and Decreasing functions and First derivative test-Second derivative test-Maxima and Minima-Concavity. Integration-Average function value - Area between curves - Volumes of solids of revolution - Beta and Gamma functions–interrelation

Module:2	**Laplace transforms**	**7 hours**

Definition of Laplace transform-Properties-Laplace transform of periodic functions-Laplace transform of unit step function, Impulse function-Inverse Laplace transform-Convolution.

Module:3	**Multivariable Calculus**	**4 hours**

Functions of two variables-limits and continuity-partial derivatives –total differential-Jacobian and its properties.

Module:4	**Application of Multivariable Calculus**	**5 hours**
Taylor's expansion for two variables–maxima and minima–constrained maxima and minima-Lagrange's multiplier method.		
Module:5	**Multiple integrals**	**8 hours**
Evaluation of double integrals–change of order of integration–change of variables between Cartesian and polar co-ordinates - Evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical co-ordinates- evaluation of multiple integrals using gamma and beta functions.		
Module:6	**Vector Differentiation**	**5 hours**
Scalar and vector valued functions – gradient, tangent plane–directional derivative-divergence and curl–scalar and vector potentials–Statement of vector identities-Simple problems		
Module:7	**Vector Integration**	**5 hours**
line, surface and volume integrals - Statement of Green's, Stoke's and Gauss divergence theorems -verification and evaluation of vector integrals using them.		
Module:8	**Contemporary Issues:**	**2 hours**
Industry Expert Lecture		
	Total Lecture hours:	**45 hours**

Text Book(s)

[1] Thomas' Calculus, George B.Thomas, D.Weir and J. Hass, 13th edition, Pearson, 2014.
[2] Advanced Engineering Mathematics, Erwin Kreyszig, 10th Edition, Wiley India, 2015.

Reference Books

1. Higher Engineering Mathematics, B.S. Grewal, 43rd Edition ,Khanna Publishers, 2015
2. Higher Engineering Mathematics, John Bird, 6th Edition, Elsevier Limited, 2017.
3. Calculus: Early Transcendentals, James Stewart, 8th edition, Cengage Learning, 2017.
4. Engineering Mathematics, K.A.Stroud and Dexter J. Booth, 7th Edition, Palgrave Macmillan (2013)

Mode of Evaluation

Digital Assignments, Quiz, Continuous Assessments, Final Assessment Test

List of Challenging Experiments (Indicative)		
1.	Introduction to MATLAB through matrices, and general Syntax	3 hours
2	Plotting and visualizing curves and surfaces in MATLAB –	3 hours

	Symbolic computations using MATLAB	
3.	Evaluating Extremum of a single variable function	3 hours
4.	Understanding integration as Area under the curve	3 hours
5.	Evaluation of Volume by Integrals (Solids of Revolution)	3 hours
6.	Evaluating maxima and minima of functions of several variables	3 hours
7.	Applying Lagrange multiplier optimization method	2 hours
8.	Evaluating Volume under surfaces	2 hours
9.	Evaluating triple integrals	2 hours
10.	Evaluating gradient, curl and divergence	2 hours
11.	Evaluating line integrals in vectors	2 hours
12.	Applying Green's theorem to real world problems	2 hours
	Total Laboratory Hours	**30 hours**

Mode of Assessment:			
Weekly assessment, Final Assessment Test			
Recommended by Board of Studies	12-06-2015		
Approved by Academic Council	No. 37	Date	16-06-2015