JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF MECHANICAL ENGINEERING

I Year I Semester		L	T	P	C
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CALCULUS & DIFFERENTIAL EQUATIONS-M1					

Course Objectives:

- To familiarize a variety of well-known sequences and series, with a developing intuition about the behaviour of new ones.
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- utilize mean value theorems to real life problems (L3)
- solve the differential equations related to various engineering fields (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- apply double integration techniques in evaluating areas bounded by region (L3)
- students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems(L5)

UNIT – I: Sequences, Series and Mean value theorems: **(10hrs)**

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test –Cauchy's root test – Alternate series– Leibnitz's rule.

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders, Problems and applications on the above theorem.

UNIT – II: Differential equations of first order and first degree: **(10hrs)**

Linear differential equations– Bernoulli's equations –Exact equations and equations reducible to exactform.

Applications: Newton's Law of cooling– Law of natural growth and decay– Orthogonaltrajectories–Electrical circuits.

UNIT – III: Linear differential equations of higher order: **(10hrs)**

Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, $e^{ax}V(x)$ and $x^nV(x)$ – Method of Variation of parameters, Cauchy and Legendre's linear equations.

Applications: LCR circuit, Simple Harmonic motion.

UNIT – IV: Partial differentiation: **(10hrs)**

Introduction – Homogeneous function – Euler's theorem– Total derivative– Chain rule– Jacobian – Functional dependence –Taylor's and MacLaurin's series expansion of functions of two variables. Applications: Maxima and Minima of functions of twovariables without constraints and Lagrange'smethod.

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UNIT – V: Multiple integrals: **(8 hrs)**

Double and Triple integrals – Change of order of integration in double integrals – Change of variables topolar, cylindrical and spherical coordinates.
Applications: Finding Areas and Volumes.

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana,**Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw HillEducation.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Joel Hass, Christopher Heil and Maurice D. Weir,** Thomas calculus, 14thEdition, Pearson.
3. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press, 2013.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.