Department of Mathematics
Faculty of Mathematics & Computer Science
PhD, Mathematics

Course Code	AM 509
Course Title	Quantum Calculus
Course Credits	02

Course objectives:

Quantum calculus is the kind of calculus that works without limit. The tools of quantum calculus widen the scope of study of various application areas such as Fourier Analysis, ODE, PDE, Operator Theory etc. The aim, in this course, would be to give basic ingrediants of q-calculus and apply them in studying certain integral transforms, integral inequalities and differential equations.

Minimum Pre-requisites:

Basic knowledge of calculus and analysis will be useful.

Course structure:

Quantum Calculus on R : q-derivative and its properties, q-binomial expansion and q-binomial coefficients, q-exponential functions, q-trigonometric functions, Jackson integrals, Fundamental Theorem of q-calculus, Integration by parts, q-Gamma and q-Beta functions.

Applications of Quantum Calculus: Integral Inequalities, Melline Transform.

Quantum Calculus on Finite Intervals : Baisc properties of derivatives and integrals, First order q_k- impulsive difference equations, Second order q_k - impulsive difference equations, q-analogue on finite intervals of the following integral inequalities: Hölder, Hermite-Hadamard, Trapezoidal, Ostrowski, Cauchy-Bunyakovsky-Schwarz, Grüss, Grüss-Cebysev.

Reading suggestions:

- **V. Kac and P. Cheung,** *Quantum Calculus,* Universitext, Springer, 2002.

- **B. Ahmad, S. Ntouyas and J. Tariboon,** *Quantum Calculus: New Concepts, Impulsive IVPs and BVPs, Inequalities,* World Scientific, 2016.

- **T. Earnst,** *A Comprehensive Treatment of q-Calculus, Birkhäuser,* 2012.

- **A. Fitouhi, N. Bettaibi, and K. Brahim,** *The Mellin transform in quantum calculus*, Constr. Approx., 23 (2006), 305–323.

Evaluation and weightage:

- **Mid-Term Examination (20%):** During the middle of the session, there will be a written examination.
- **Assignments (20%):** In all 4 assignments will be given, one in each month.
- **Quiz/Presentations (20%):** As per the lecture schedule, Quiz session will be organized and students will be asked to make presentations. The topics will be assigned during the lectures.
- **Term-End Examination (40%):** At the end of the session, there will be another written examination.