Theoretical Problem 2: Ball on turntable
Q2 – Marking Scheme

Question part	Total marks	Partial marks	Explanation for partial marks and special cases
A.1	0.1	0.1	Kinematic constraint from non-slipping condition
A.2	0.2	0.1 0.1	Time derivative of the constraint equation Expression for the linear acceleration of the ball
A.3	0.2	0.1 0.1	Time integral of the acceleration with initial values Velocity formula in terms of initial values
A.4	0.5	0.2 0.3	Identification of trajectory radius Identification of the center of the trajectory
A.5	0.5	0.2 0.3	Calculate the return time on the same spot in general Calculate the return time on the same spot for spectial case
B.1	0.2	0.1 0.1	Velocity formula Acceleration
B.2	0.6	0.3 0.3	Angular acceleration of the turntable with the ball's velocity dependency and coordinates Angular acceleration of the turntable with the ball's coordinates dependency
B.3	0.6	0.3 0.3	Find scalar product of coordinate and velocity Integrate and obtain table's angular velocity depending on magnitude of position only
B.4	0.1	0.1	Maximum table's angular velocity
B.5	2.5	0.5 0.5 0.9 0.6	Calculate table's angular velocity using conservation of angular momentum Calculate table's angular velocity in the given coordinates Find the equation for the curve List the possible trajectories
C.1	0.5	0.2 0.3	Newton's equation Spinning torque due to magnetic field
C.2	0.5	0.2 0.3	Acceleration formula including spinning of the ball Acceleration formula and 2^{nd} order diff equation

C.3	1.0	0.5 0.3 0.2	Transformation to polar system removing the first time Identification of angle function and beta’ Classification of time behavior of rho(t)
C.4	0.9	0.5 0.3 0.1	Identification of the curve from the initial condition Find angular velocity of the table Identify the charge sign
C.5	1.6	0.4 0.4 0.3 0.3 0.2	Calculation of the total kinetic energy change from linear motion Calculation of the kinetic energy change from linear motion per revolution Calculation of the total kinetic energy change from spinning Calculation of the kinetic energy change from spinning per revolution Total energy change