Theory of Plates

**Homework 9**

9.6-1 A circular plate clamped at the edge \( r = a \) is subjected to uniformly distributed load \( q_0 \) and a temperature change \( \Delta T = kz \), where \( k \) is a constant. Find the deflection \( w \) and moments \( M_r, M_\theta \) of the plate. (10 Points)

![Diagram of a circular plate with uniformly distributed load](image)

9.6-2 A circular plate is simply supported at \( r = a \) and has a point support at center. The plate is subjected to a temperature change \( \Delta T(r,z) = kr^2z \), where \( k \) is a constant. Find the solution of the plate by solving the differential equation. (10 Points)

![Diagram of a circular plate with point support and temperature change](image)

9.6-3 A circular plate has a point support at center and is subjected to a temperature change \( \Delta T(r,z) = kr^2z \), where \( k \) is a constant. Find the solution of the plate by solving the differential equation. (10 Points)

![Diagram of a circular plate with point support and temperature change](image)

9.6-4 A circular plate is sliding supported at \( r = a \) and has a point support at center. The plate is subjected to a temperature change \( \Delta T(r,z) = kr^2z \), where \( k \) is a constant. Find the solution of the plate by solving the differential equation. (10 Points)

![Diagram of a circular plate with sliding support and temperature change](image)

9.7-1 Repeat Problem 9.6-1 by using the analogy of isothermal plate. (10 Points)

9.7-2 Repeat Problem 9.6-2 by using the analogy of isothermal plate. (10 Points)

9.7-3 Repeat Problem 9.6-3 by using the analogy of isothermal plate. (10 Points)

9.7-4 Repeat Problem 9.6-4 by using the analogy of isothermal plate. (10 Points)
9.10-1 A square plate is simply supported at \( x = 0 \), sliding at \( x = a \), and fixed at \( y = 0, y = a \). The plate is subjected to inplane force \( N_X = -N \) and a temperature change \( \Delta T(z) = kz \), where \( k \) is a constant. Assume \( v = 0 \) and the displacement of the plate is \( w(x,y,t) = Z(x,y)\sin \omega t = \beta \phi(x,y)\sin \omega t \). (i) Select appropriate shape function \( \phi(x,y) \) using the polynomial. (ii) Use the Ritz method to obtain the fundamental frequency \( \omega_f \) and the critical buckling load \( N_{cr} \) of the plate. (10 Points)

9.10-2 A circular plate has the boundary conditions as shown. The plate is subjected to inplane force \( N_r = -N \) and a temperature change \( \Delta T(z) = kz \), where \( k \) is a constant. Assume the displacement of the plate is \( w(r) = \beta [1 - \cos(\pi r/a)] \). Use the Ritz method to calculate the critical buckling load \( N_{cr} \) of the plate. (10 Points)

9.10-3 A circular plate is simply supported at \( r = a \). The plate is subjected to inplane force \( N_r = -N \) and a temperature change \( \Delta T(z) = kr^2z \), where \( k \) is a constant. Assume the displacement of the plate is \( w(r) = \beta \phi(r) \). (i) Select appropriate shape function \( \phi(r) \) using the polynomial. (ii) Use the Ritz method to obtain the critical buckling load \( N_{cr} \) of the plate. (10 Points)

9.10-4 A circular plate is fixed at \( r = a \). The plate is subjected to inplane force \( N_r = -N \) and a temperature change \( \Delta T(z) = kr^2z \), where \( k \) is a constant. Assume the displacement of the plate is \( w(r,t) = Z(r)\sin \omega t = \beta \phi(r)\sin \omega t \). (i) Select appropriate shape function \( \phi(r) \) using the polynomial. (ii) Use the Ritz method to obtain the fundamental frequency \( \omega_f \) and the critical buckling load \( N_{cr} \) of the plate. (10 Points)

9.11-1 Repeat problem 9.10-1 by using the Galerkin method. (10 Points)

9.11-2 Repeat problem 9.10-2 by using the Galerkin method. (10 Points)

9.11-3 Repeat problem 9.10-3 by using the Galerkin method. (10 Points)

9.11-4 Repeat problem 9.10-4 by using the Galerkin method. (10 Points)

9.12-1 Repeat problem 9.10-1 by using the Finite Difference method with the given mesh. (10 Points)