Department of Aerospace Engineering
AE-332 Aerospace Structures - II
Assignment No. 5 (Plate Bending)

1. A thin rectangular plate of length $\boldsymbol{a}$ and width $\boldsymbol{2a}$ is simply supported along the edges $x = 0, x = a,$ $y = -a \; and \; y = +a$. The plate has a flexural rigidity $\boldsymbol{D}$, a Poisson's ratio of 0.3 and carries a load distribution given by $q(x, y) = q_o \sin(\pi x/a)$. If the deflection of the plate may be represented by the expression

$$w = \frac{qa^4}{D\pi^4}\left(1 + A\cosh\frac{\pi y}{a} + B\,\frac{\pi y}{a}\sinh\frac{\pi y}{a}\right)\sin\frac{\pi x}{a}$$

Determine the values of the constants A and B.

2. A thin, elastic square plate of side $\boldsymbol{a}$ is simply supported on all four sides and supports a uniformly distributed load q. If the origin of axes coincides with the centre of the plate show that the deflection of the plate can be represented by the expression

$$w = \frac{q}{96(1-v)D}[2(x^4 + y^4) - 3a^2(1-v)(x^2 + y^2) - 12vx^2y^2 + A]$$

where $\boldsymbol{D}$ is the flexural rigidity, v is the Poisson's ration and A is a constant. Calculate the value of A and hence the central deflection of the plate.

3. The deflection of a square plate of side $\boldsymbol{a}$ which supports a lateral load represented by the function $q(x, y)$is given by

$$w(x, y) = w_0 cos\frac{\pi x}{a} cos\frac{3\pi y}{a}$$

where $x \; and \; y$ are referred to axes whose origin coincides with the centre of the plate and w_0 is the deflection at the centre.

If the flexural rigidity of the plate is D and Poisson's ratio is v. Determine the loading function q, the support conditions of the plate, the reactions at the plate corners and the bending moments at the centre of the plate.