# MA20103 - Partial differential equations Assignment

August 10, 2016

**Submit the assignment on or before Wednesday 17 August 2016 at 8.00 am, late submissions will carry no marks. You can drop the assignment in my office N340.**

1. (Problem 10, Page 179, Kreysig's book) Define generating function of a sequence. Show that

$$G(u,x) = \frac{1}{\sqrt{1-2xu+u^2}} = \sum_{n=0}^{\infty} P_n(x)u^n$$

   is a generating function of the sequence of Legendre polynomials $P_0(x), P_1(x), \ldots, P_n(x), \ldots$.

2. (Problem 14, Page 180, Kreysig's book)(Bonnet's formula) Prove that

$$(n+1)P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x),$$

   where $n = 1, 2, \ldots$.(Using the generating function)

3. (Bonnet's formula) Prove that

$$(n+1)P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x),$$

   where $n = 1, 2, \ldots$.(Using the Rodrigues's formula)

4. (Problem 13, Page 195, Kreysig's book)Using Rolle's theorem, show that between any two consecutive zeros of $J_n(x)$ there is precisely one zero of $J_{n+1}(x)$, where $J_n(x)$ denotes the Bessel function of first kind of order $n$.