TEZPUR UNIVERSITY
Assignment Spring 2022
MMS 401: Mathematical Methods
Total Marks: 30

The figures in the right-hand margin indicate marks for the individual question.
All questions are compulsory.
Answers should be concise and entire answer to a question should be together. State assumptions wherever made.

1. Convert the differential equation $\frac{d^2\phi}{dx^2} + x\phi = 1$ with boundary condition $\phi(0) = 0, \quad \phi(1) = 1$ to its corresponding Fredholm integral equation of second kind and also recover the boundary value problem from the integral equation that you obtain. **7**

2. Show that $\int x^m J_n(x)dx = \frac{x^{m+2}J_{n+1}}{(m+1-n)(m+1+n)} + \frac{x^{m+1}J_n}{(m+n+1)} + \frac{\int x^{m+2}J_n dx}{(m+1-n)(m+1+n)}$ and evalute $\int x^{-2}J_4(x)dx$. **7**

3. Show $P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n \quad$ for $\quad n \geq 1$. **5**

4. Show that Legendre polynomils are orthogonal . **5**

5. Find the Green's function for damped harmonic oscillator given by the equation $m\frac{d^2y}{dt^2} + c\frac{dy}{dt} + ky = f(t)$, with m mass of the spring, c damping coefficient, k spring constant and *f(t)* force . **6**

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