B. M. S. COLLEGE OF ENGINEERING, BANGALORE-560 019
DEPARTMENT OF MATHEMATICS

Fourth Semester B.E. Course-(AS/ME/EEE/ECE/ET/ML/CIVIL/EIE)
Course Title: Complex Analysis, Probability and Statistical Methods
Course Code: 22MA4BSCPS

UNIT 2: SPECIAL FUNCTIONS

1. Obtain series solution of Bessel's differential equation leading to $J_n(x)$.
2. Prove that $J_{-n}(x) = (-1)^n J_n(x)$ where n is a positive integer.
3. Prove that $J_n(-x) = (-1)^n J_n(x) = J_{-n}(x)$ where n is a positive integer.
4. Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$
5. Prove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} \cos x$
6. Derive the generating function for Bessel polynomial in the form $e^{\frac{x}{2}(t-1/t)} = \sum_{n=-\infty}^{\infty} J_n(x) t^n$
7. Obtain series solution of Legendre's differential equation leading to $P_n(x)$.
8. Derive the generating function for Legendre polynomial in the form

   $(1-2xt+t^2)^{-1/2} = \sum_{n=0}^{\infty} P_n(x) t^n$ where $P_0(x) = 1$.
9. Express the following in terms of Legendre polynomial
   a. $x^3 - 5x^2 + 6x + 1$
   b. $x^3 + 2x^2 - x - 3$
   c. $4x^3 + 6x^2 + 7x + 2$
   d. $1 + 2x + x^2$
   e. $x^3 + 5x^2 + 6x + 1$
   f. $x^3 + 2x^2 - 4x + 5$
   g. $x^3 + 2x^2 - x + 1$
   h. $x^3 + x^2 + x + 1$
   i. $4x^3 - 2x^2 - 3x + 8$
10. Evaluate $P_0(x), P_1(x), P_2(x)$ and $P_3(x)$ by using the Rodrigue's formula.