B.Tech / Integrated (MBA/M.Tech) 1st Semester Examination  
June - July 2013  
APPLIED MATHEMATICS -I  
Subject Code: AHL103  

Time Allowed: 03 hours.  
Maximum Marks: 100  

Before answering the question paper the candidate should ensure that they have been supplied the correct question paper. Complaints in this regard, if any, shall not be entertained after the examination.  

Note: Attempt any five questions and all questions carry equal marks.

Section – A  
1. (a) Compute the inverse of the following matrix by using Elementary Transformations:  
   \[
   A = \begin{bmatrix}
   1 & 2 & 5 \\
   2 & 3 & 1 \\
   -1 & 1 & 1
   \end{bmatrix}
   \]  
   [10]  

(b) Verify Cayley –Hamilton theorem for the matrix  
   \[
   A = \begin{bmatrix}
   7 & 2 & -2 \\
   -6 & -1 & 2 \\
   6 & 2 & -1
   \end{bmatrix}
   \]  
   [10]  

2. (a) Find the value of the nth derivative of  
   \[y = e^{m \sin^{-1} x}\] for \(x = 0\)  
   [6]  

(b) Find the co-ordinates of the centre of curvature for any point \((x, y)\) on the parabola \(y^2 = 4ax\)  
   [8]  

(c) Find the asymptotes, parallel to axes, of the following curve  
   \[x^2y^2 - x^2y - xy^2 + x + y + 1 = 0\]  
   [6]  

Section – B  
4. (a) Test the convergence of the series:  
   \[1 + \frac{1}{2^2} + \frac{2^2}{3^3} + \frac{3^3}{4^4} + \cdots\]  
   [10]  

(b) For what values of \(x\) are the following series convergent:  
   \[x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} - \cdots\]  
   [10]  

5. (a) If \(u = \sin^{-1} \frac{x}{y} + \tan^{-1} \frac{y}{x}\), prove that  
   \[x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0\]  
   [8]  

(b) If \(u = \frac{y^2}{2x}, v = \frac{x^2+y^2}{2x}\), find  
   \[\frac{\partial(u, v)}{\partial(xy)}\]  
   [12]  

6. (a) Solve the following differential equation:  
   \[(mx-ny)p + (nx-lz)q = ly-mx\]  
   [6]  

(b) Solve \((p - q)(z-px-qty) = 1\)  
   [6]  

(c) Solve the following equation:  
   \[p(1 + q) = qz\]  
   [8]