King Fahd University of Petroleum & Minerals
Department of Mathematics & Statistics
Math 571 Final Exam
The First Semester of 2014-2015 (141)
Time Allowed: 150 Minutes

Name: _____ ID#: _____

Q:1 Use Schur criterion to determine whether or not all zeros of the polynomial

$P(z) = 3z^3 + 3z^2 + 2z + 1$ lie in the unit disc.

Q:2 Define $f : \mathbb{R}^3 \to \mathbb{R}^3$ by $f(y^1, y^2, y^3) = \begin{bmatrix} y^1 y^2 + y^3 \\ 2y^1 + 3y^2 y^3 \\ 5 + y^1 + y^2 + y^3 \end{bmatrix}$

Find the formulae for the elementary differentials $F(t)$ for the threes $t = [\tau^2]$ and $t = [\tau^3]$.

Q:3 For the Runge–Kutta method $\begin{array}{ccc} \frac{1}{2} & \frac{3}{4} & \frac{-1}{4} \\ 1 & \frac{1}{2} & \frac{1}{2} \\ & \frac{2}{3} & \frac{1}{3} \end{array}$

find the elementary weights for the eight trees up to order 4. What is the order of the method.

Q:4 For the following pairs of polynomials $[\alpha(z), \beta(z)]$, determine if the corresponding numerical method is consistent and stable:

1. $[1 - z + z^2 - z^3, 2z + z^2]$
2. $[1 - z^2 - z^3, 2z - z^2]$

Q:5 Draw the following trees (i) $[[\tau]\tau^3]$, (ii) $[[\tau^2]\tau^2]$, (iii) $[\tau[\tau^2]]$.

Find the values of $\sigma(t),\ \gamma(t),\ \alpha(t),\ \beta(t)$ for each tree. Also write the order condition for each tree.