Surname: ..... Forename: ..... MatrNo.: .....

Exam: Mathematics 1

Hamburg University of Applied Science
Faculty of Engineering & Computer Science, Department of Information and Electrical Engineering
Prof. Dr. Robert Heß, 2.7.2014, duration: 90 Min.

Result: ..... of 100 points Mark: ..... points.

Problem 1 (20 points)

Prove by mathematical induction: $1 + \sum_{k=1}^{n} \frac{2^{2k-2}}{3^k} = \left(\frac{4}{3}\right)^n$

Problem 2 (15 points)

Check for convergence: $f : \mathbb{C} \to \mathbb{C}, z \mapsto \sum_{k=0}^{\infty} \frac{3^k (z+\mathrm{j})^k}{k!}$

Problem 3 (15 points)

Resolve, i.e. differentiate the following expressions:

$$a = \frac{\mathrm{d}}{\mathrm{d}y}\, e^{xy} \sin(2z) \qquad b = \frac{\mathrm{d}}{\mathrm{d}x}\, \frac{x^2-1}{e^{2x}} \qquad c = \frac{\mathrm{d}^n}{\mathrm{d}x^n}\, \hat{u}\, e^{\mathrm{j}\omega x}$$

Problem 4 (20 points)

Analyse the function $f(x) = x^4 - 24x^2 + 12x - 6$ with respect to inflection and saddle points.

Problem 5 (10 points)

You want to evaluate the power P absorbed in a resistor by measuring its resistance R with an accuracy of 2% and the applied voltage U with an accuracy of 0.5%. For the absorbed power given by $P = U^2/R$ what accuracy do you expect?

Problem 6 (20 points)

Solve the following SLE:

$$a + b + c + d = 2, \qquad b - c + d = 1, \qquad -a + c + d = -2, \qquad a - b = -1$$