

# NUMERICAL METHODS

## MID TERM EXAM

Max Marks: 30

Wednesday Sep. 27, 2017

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Time: 4.30-6.00

1. The real root of following equation upto two decimal accuracy is:  
 $5x - 2 \sin x - 1 = 0$

[5]

2. Find approximation of following function for second order Taylor series using  $x_i=0$ ,  $h=1$ , and  $x_i=0$ ,  $h=0.5$   
 $f(x) = 0.1x^4 + 0.15x^3 + 0.5x^2 + 0.25x + 1.2$

[4]

3. Find remainder for first order Taylor series of the following function for  $x_i=1$ ,  $h=1$ ,  $m=4$ , and  $x_i=1$ ,  $h=0.5$ ,  $m=4$   
 $f(x) = (x+1)^m$

[4]

4. The following equation represents velocity of parachutist. Find drag coefficient ( $c$ ) using bisection method to until 2 iterations.  $m=70$  kg,  $v=40$  m/s at  $t=10$  s,  $c_1=12$  Ns/m,  $c_u=16$  Ns/m.

$$v = \frac{mg}{c} \left( 1 - e^{-\frac{ct}{m}} \right)$$

[4]

5. The following are the system of equations generated by applying the mesh current law to a circuit. Solve  $I_1$ ,  $I_2$ ,  $I_3$  using Gauss elimination method.

$$60I_1 - 40I_2 = 200$$

$$-40I_1 + 150I_2 - 100I_3 = 0$$

$$-100I_2 + 130I_3 = 230$$

[5]

6. Derive the coefficients of linear regression model for the following data:  $(x_1, y_1)=(1, 1)$ ,  $(x_2, y_2)=(2, 3)$ ,  $(x_3, y_3)=(3, 2)$ .

[5]

7. Using Lagrange interpolation of following function, find the value at  $x=2$  for the data:  
 $x_0=1$ ,  $x_1=3$ ,  $x_2=6$ .

$$f(x) = \ln x$$

The Lagrange interpolating polynomial is represented as

$$f(x) = \sum_{i=0}^n L_i(x) f(x_i), \text{ where } L_i(x) = \prod_{\substack{j=0 \\ j \neq i}}^n \frac{x - x_j}{x_i - x_j}$$

[3]