2018209140

OWERRI

FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF CHEMICAL ENGINEERING
2018/2019 RAIN SEMESTER EXAMINATIONS
ENG 308- ENGINEERING MATHEMATICS II **DATE: OCT. 29, 2019**
INSTRUCTION: ATTEMPT ANY 5 QUESTIONS **TIME ALLOWED: 3HOURS**

1a) A continuous signal f(x) is given as $f(x) = 5 + 2\cos(2xt - 90^o) + 3\cos(4xt)$ and is sampled at 4 times per second. Determine the values of the discrete samples i.e. f (0), f (1), f (2) and f (3) (8 marks). (b) The input to an 8-point fast Fourier transition (FFT) are a_0, a_1, a_2, a_3, a_4, a_5, a_6, a_7. Produce the butterfly diagram for such an FFT and show clearly using bit reversal how the input data are paired (12 marks).

2) A system can be represented using the differential equation given below: $y''' + 10y'' + 31y' + 30y = 6u$. Obtain a state space representation in the controllable canonical form and find its zero input response using initial conditions; y(0) =1, y' (0) = 0 (20 marks).

3) Write the generalized formulas for the function value y_{n+1} for the numerical methods of *Euler* and *Euler-Cauchy* used in solving first-order ordinary differential equations (2 marks).

b) Using the method of *RungeKutta*, solve the initial value problem given that y(0)=1 for x= 0.0(0.1)0.2. Express the results to 6 places of decimals (18 marks). [HINT: $k_1 = hf(x_n, y_n) = h$; $k_2 = hf(x_n + h, y_n + k_1)$; $k_3 = hf(x_n + h, y_n + k_2)$; $k_4 = hf(x_n + h, y_n + k_3)$; $y_{n+1} = y_n + (k_1 + 2k_2 + 2k_3 + k_4)$.

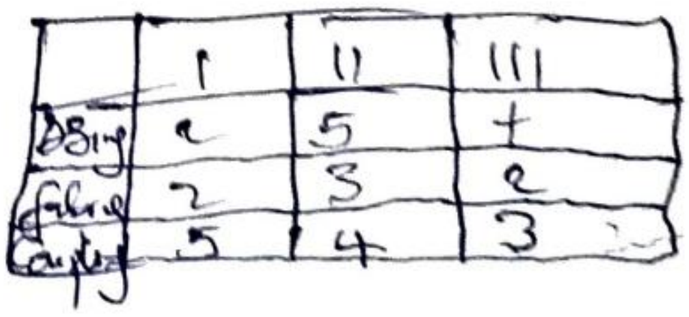
4a) Using the values in the table below, find dy/dx at x = 0.26 using the 3-point Lagrange:

x	0.0	0.2	0.4	0.6
y	0.00000	0.19867	0.38942	0.56464

b) Approximate p(0.7) for $f(x) = e^x$ using the following data and the Newton's interpolatiory divided difference. x_0=0.0, x_1=0.2, x_2=0.4, x_3=0.6, x_4=0.8. Determine the error of approximation.

5) A company produces three types of reactors I, II, III with profit margin of N35, N30, N24 per unit respectively. The firm has 20 men available for Design, 16 men available for fabrication and 24 for coupling, and all staff work a 50 hour week. To remain in the business, at least 300 reactors in all must be produced each week. Using the table below: Determine (a) The number of model to be produced each week in order to maximize the profit. (b) The maximum weekly profit (20 marks).

Process	Time in hours per reactor		
	I	II	III
Design	2	5	4
Fabrication	2	3	2
Coupling	5	4	3



6) Consider an electronic system consisting of four components each of which must work for the system to function. The system reliability can be improved by installing several parallel units in the system components. The table below gives the probability that the respective components (comp.) will function if they consist of one, two or three parallel units.

2.0138

0.00312845