Federal University of Technology, Owerri
School of Engineering and Engineering Technology
2011/2012 SESSION: Rain Semester Examination; August 2012. Time Allowed: 3 Hours
ENG 308: Engineering Mathematics II
Answer Any Five (5) Questions.

Question one

In a diffusion transport phenomena the following equation is formulated $\frac{\partial C_A}{\partial t} = \frac{\partial}{\partial x}(J) + r_A$,

where r_A is first order reaction (KC_A) and J is first Fick's law $\left(-D\frac{\partial C_A}{\partial x}\right)$

(a).Obtain a 2nd order PDE therefrom .

(b). solve the 2nd order PDE using separation of variables technique.

Question Two

(a).Evaluate $J = \int_0^1 e^{-x} dx$ by means of trapezoidal rule with n= 20. Solve the integral analytically and determine the error.

(b) Solve $y^1 = x + y$ using Euler's method for x = 0.0(0.2) 1.0 given that y (0) = 0. Find the exact solution and the error.

Question Three

(a). Using Cramer's rule, solve the following set of linear algebraic equations.

$$0.3x_1 + 0.52x_2 + x_3 = -0.01$$
$$0.5x_1 + x_2 + 1.9x_3 = 0.67$$
$$0.1x_1 + 0.3x_2 + 0.5x_3 = -0.44$$

(b) .Determine the eigenvalues and eigenvectors for the equation :

$$A.X = \lambda X, \text{ where } A = \begin{bmatrix} 2 & 0 & 1 \\ -1 & 4 & -1 \\ -1 & 2 & 0 \end{bmatrix}$$

Question Four

(a). Minimize $P = 4x - 8y + 5z$.

Subject to

$$2x + 3y + z \le 70$$
$$x + 2y + 2z \le 60$$
$$3x + 4y + z \le 84$$
$$x + y + z \ge 33$$

(b). A firm manufacturing two types of switching module, A and B, is under contract to produce a daily output of at least 35 modules in all . Assembly and testing times for each type of moduleare given as follows

Module type	Process time (hours)	
	Assembly	Testing
A	1.0	2.0
B	2.0	1.0

Available staff resources provide a daily maximum of 80 hours for assembly and 55 hours for testing. The profit on the sale of each A- module is £4.00 and of each B-module is £5.00. Determine
(i). The daily production schedule for maximum profit. (ii). The maximum daily profit.

Question Five

		Destination				
		A	B	C	D	
Source	1	6	20 5	4	20 3	40
	2	20 4	20 4	10 6	7	50
	3	7	6	30 6	5	30
		20	40	40	20	

Table 5.0b

		Cities			
		A	B	C	D
	1	2	3	4	5
Reservoirs	2	3	2	5	2
	3	4	1	2	3

Table 5.0a

(a). We have three reservoirs with daily supplies of 15, 20, 25 million liters of fresh water respectively. On each day we must supply four Cities A, B, C, and D whose demands are 8, 10, 12, and15 respectively. The cost of pumping per million liters is shown in table 5.0a. Use transportation algorithm to determine the cheapest pumping schedule if excess water can be disposed at no cost.

(b).(i) Determine the optimal solution of the transportation problem in table 5.0b. (ii). Is the solution unique or not ? if not, determine the alternative optimal solution.

Question Six

		Machines				
		1	2	3	4	5
	1	10	11	4	2	8
Jobs	2	7	11	10	14	12
	3	5	6	9	12	14
	4	13	15	11	10	7

Table 6.0a

		Machines		
		1	2	3
	1	5	8	4
Jobs	2	4	3	2
	3	8	6	4

Table 6.0b

(a). A batch of four jobs can be assigned to five different machines . The set-up time for each job in the various machines is given table 6.0a. Find the optimal assignment of jobs to machine which will minimize the total set-up time.

(b).Three machines are available to execute three jobs. Each job must be done on only one machine . The cost of processing each job on each machine is given in table 6.0b. Determine the minimum cost assignment for each job.